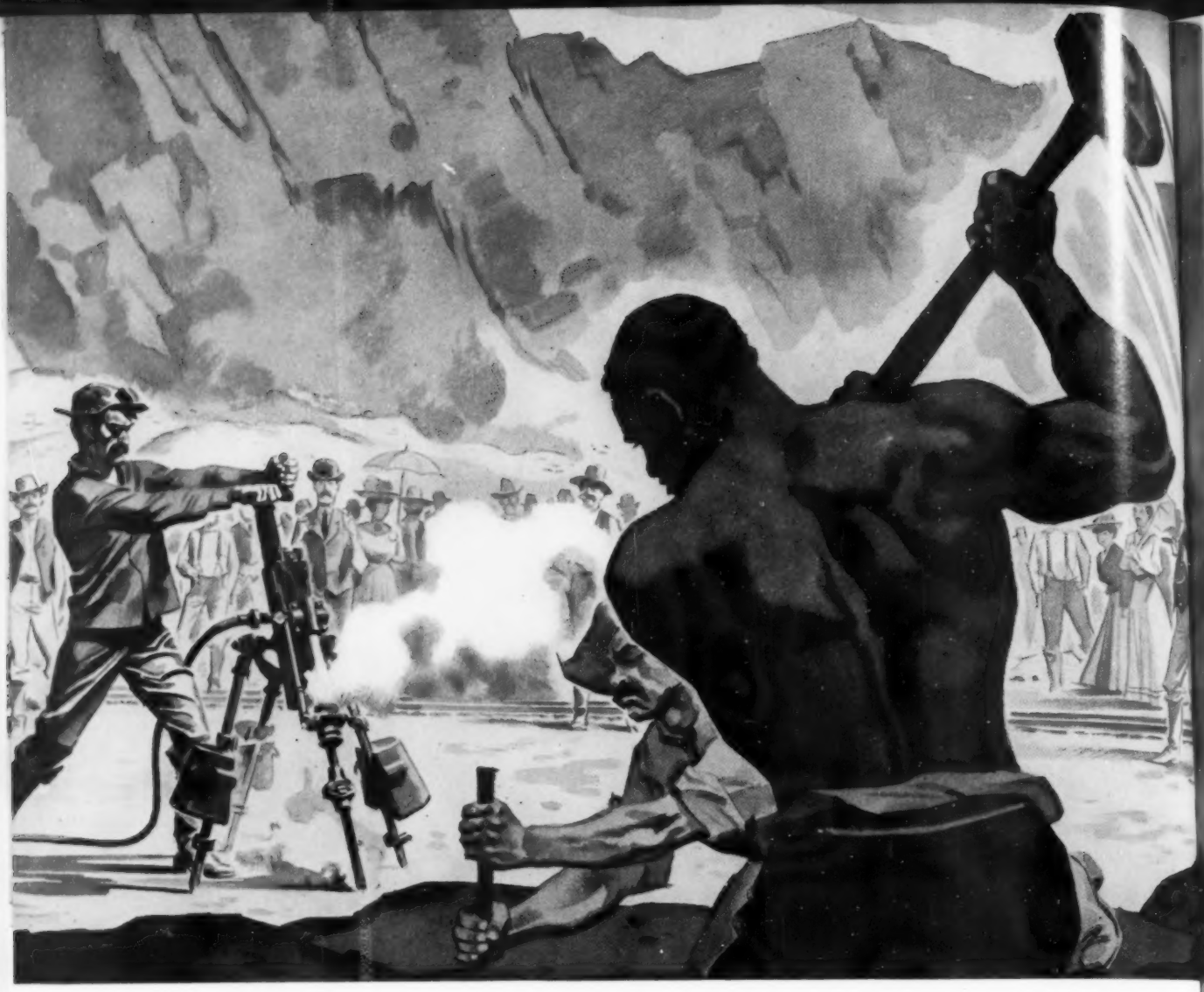
AUGUST 1954

THE TOOL ENGINEER



Electroforming

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



Machine vs. muscle — a duel to the death!

COMPETITION was *mighty* rough on the great Jawn Henry, famed steel-driving rock driller of the last century. For he pitted his strength against a steam-driven drill and *won*—only to die, hours later, from the strain. And the steam drill (later converted to air) replaced all hand methods of drilling rock.

The old order changes, yielding place to new and better ways of doing things. For competition and progress go hand in hand.

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Internal and Rotary Surface Grinding Machines

Bore-Matics

THE HEALD MACHINE COMPANY

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Offices in Chicago • Cleveland • Dayton
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Cover: As a production process electroforming opens the door to configurations difficult or impossible to make by other methods. Types of parts which can best be produced are discussed in the article beginning on page 55 along with the latest application information.



The Tool Engineer

Volume XXXIII, No. 2 August 1954

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PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and the *Industrial Arts Index*

New S.E.C.O. is Tops For These Operations



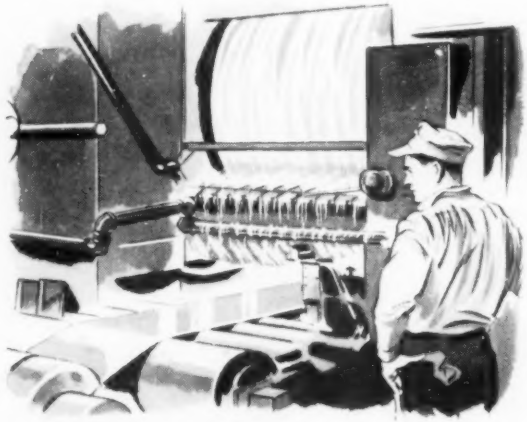
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The Tool Engineer

Know When

Largely applied to Americans by Americans, "know-how" was a word that entered the lexicon during World War II. The term meant that American industry could convert to mass production of war materiel because its designers, tool engineers and labor force had amassed production experience through the manufacture of consumer goods in quantity. During the emergency, production teams knew how to do what had to be done.

During the early post-war period and through the Korean action, know-how was given a partial discharge to civilian status. Wartime experience had benefited production know-how and tremendous quantities of consumer products were made to satisfy the demand that had built up during the war.

No longer are we faced with "production at any cost." We are in a period with an economy that has not indicated how much production it can absorb. Urgency is no longer a factor in production.

The tool engineer must fit into a new plan, must adapt himself to new conditions. Knowing how is not going to be enough in the immediate future. The tool engineer—to do his job of turning out a quality product while reducing costs—is going to have to develop "know when." He will have to know when to apply the processes and principles that make up his know-how. Only by applying the correct methods at the right time will the products for which the tool engineer is responsible continue to be competitive.

Never before have so many expected so much from so few.

Robert A. Wason
ASSOCIATE EDITOR

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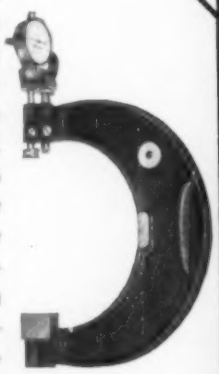


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Write for brochure on "NEW PRODUCTS" for more complete details on these instruments.



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Actual Size

Collet "B"
Actual Size

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CAPACITY: 1" Round, 7/8" Hexagon, 3/4" Square
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Collet "B"

CAPACITY: 7/8" Round, 3/4" Hexagon, 5/8" Square
USED ON: 12" and 14" American; 14" Cincinnati; 12", 14" and 16" Hendey; 12", 14", 16" and 18" Monarch; 9", 15" and 16" Rockford; 12", 14" and 16" Sebastian; 14" and 16" Springfield Lathes.

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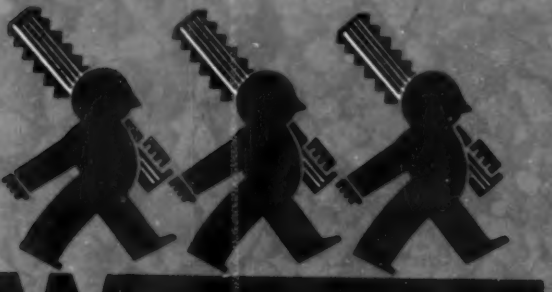
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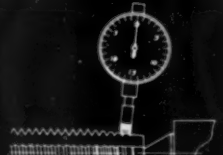
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Norgren Spray-Lube System

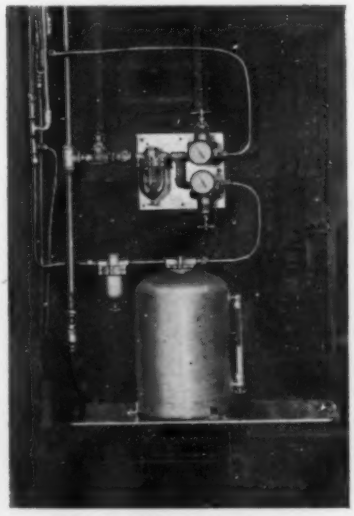
DOUBLES OUTPUT OF VERTICAL TURRET LATHE at O. K. RUBBER, INC.



4 Spray-Lube lines give full spray coverage over 14¼" cutting edge of tool.

On roughing and finishing a straight ribbon tread on cast aluminum tire capping mold, Norgren Spray-Lube:

- stepped up surface cutting speed from 45 to 75 rpm.
- increased depth of cut.
- eliminated welding of chips on cutting tool.
- ended galling of work pieces.
- reduced tool maintenance.
- improved quality of work.

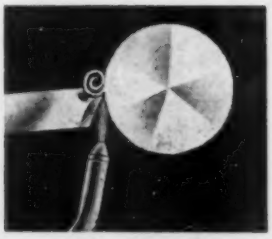


Spray-Lube control panel and liquid reservoir are centrally located for several machines.

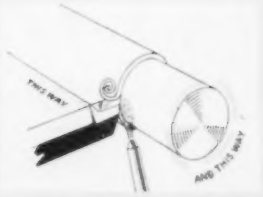
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PIONEER AND LEADER IN OIL-FOG LUBRICATION FOR 26 YEARS



Coolant where you need it . . . spray is applied to work area from any required direction to thoroughly lubricate critical contact areas between cutting tool and work piece.

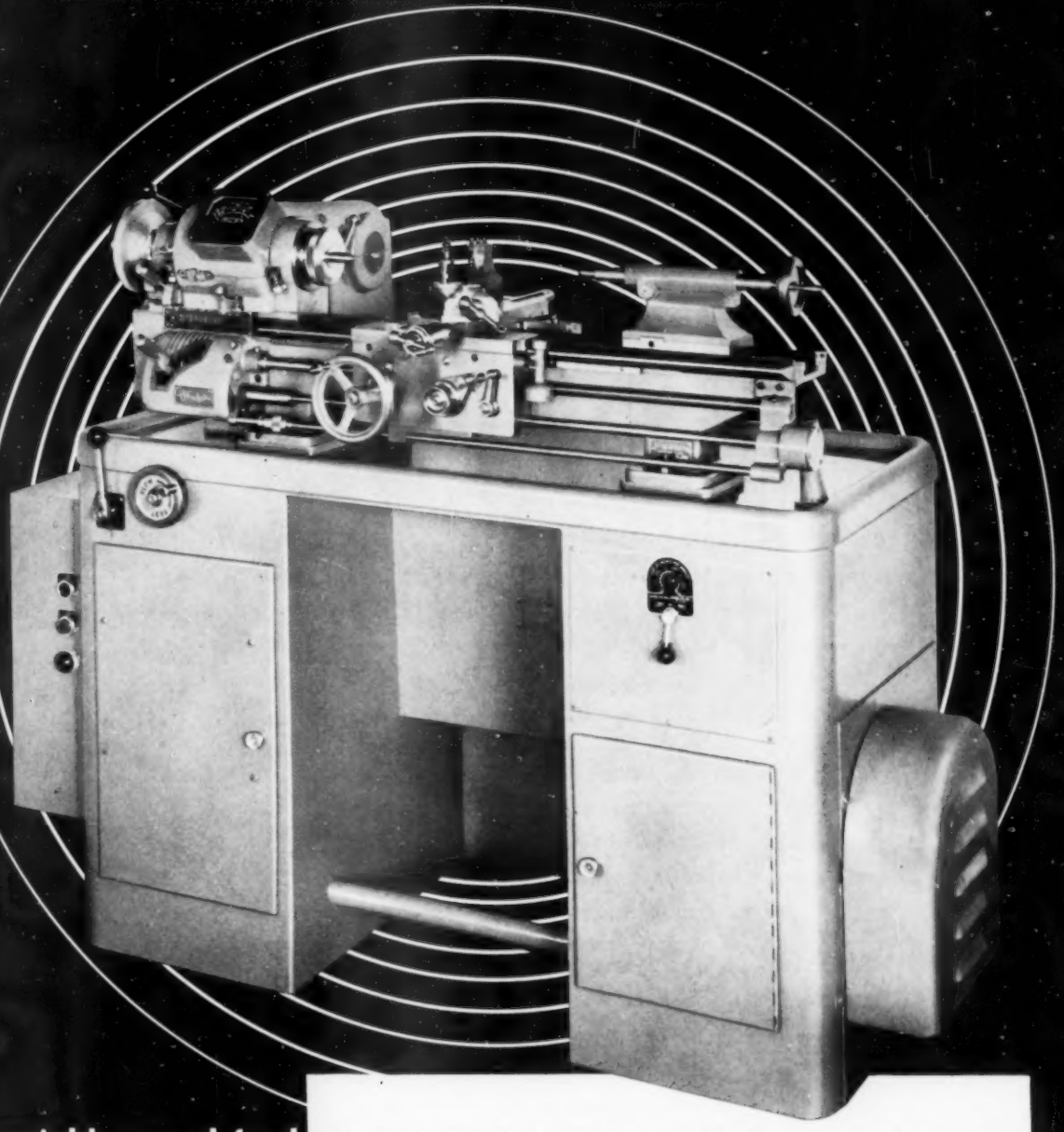


Step Up Production Speed. Rapid cooling at the cutting point will enable you to increase both the speed, and the feed of the cutting tool, and still improve workmanship and tool life. Notable increases in machine output have resulted.

VALVES FILTERS HOSE ASSEMBLIES REGULATORS LUBRICATORS

Extremely useful...

this Wade No. 8A LATHE *with variable speed feed!*

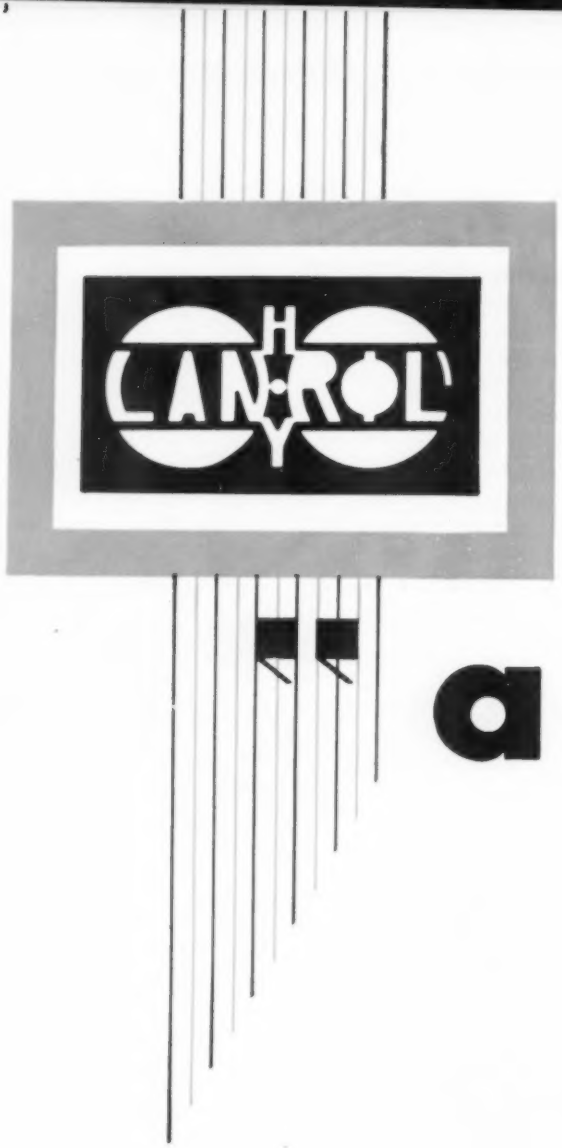


A variable speed feed for the feed rod is available as optional equipment. It provides an independent powered longitudinal or cross feed which permits the operator to change the rate of feed while the tool is under cut to secure the desired work finish during turning, facing or boring operations. The rate of feed for the variable speed feed is controlled by a potentiometer.

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Write to 59 River Street

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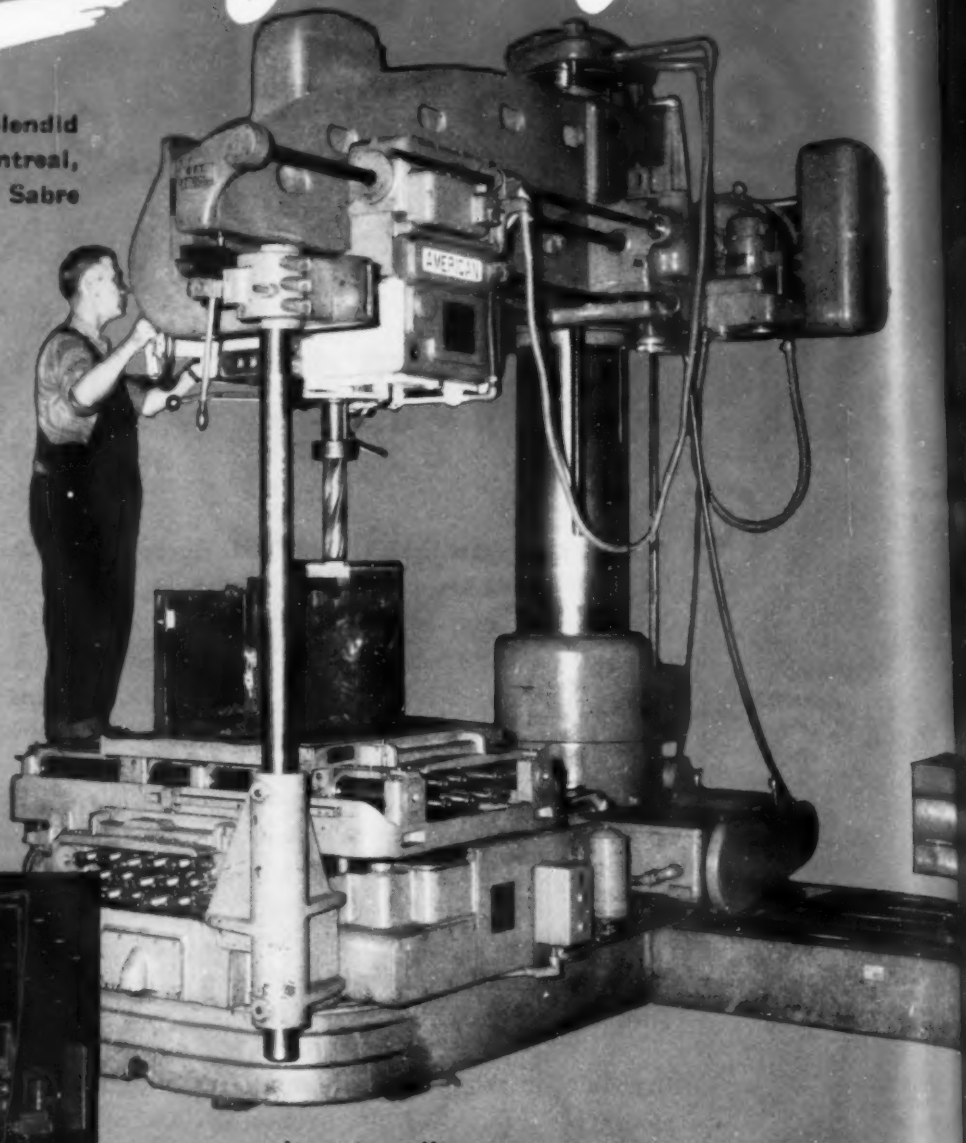
LANDIS *Machine* COMPANY

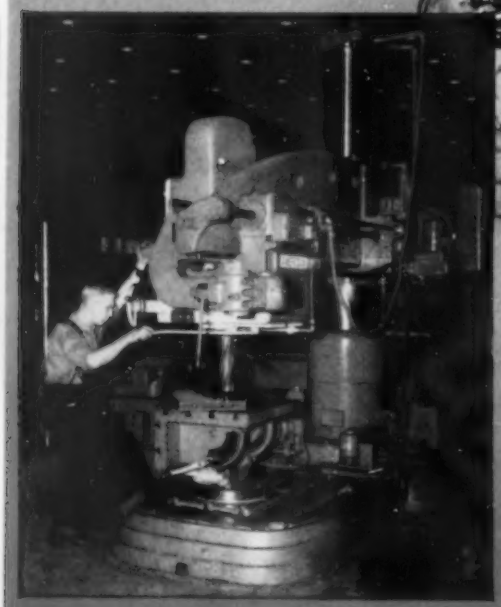
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On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.





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For a complete revelation of their virtues send for descriptive bulletin No. 327.

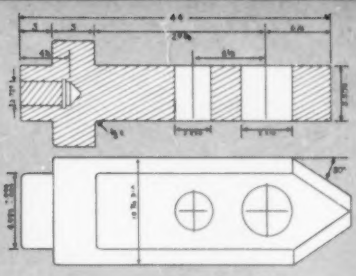
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

heavy jump cut job now turned 4 times faster



on Axelson 25" Heavy Duty Lathe



Tough 4140 steel forgings for 300 ton oil drilling hooks having 3/8" to 7/8" stock and a severe interrupted cut are now turned FOUR TIMES FASTER on Axelson Heavy Duty Lathes, using Kennametal tools. These forgings brinell 311 and weigh 800 lbs. before machining and are only one of twelve different size drill hooks manufactured. More than eight hundred drill hooks have been turned on this Axelson 25" heavy duty lathe since 1945 and it is reported that "no excess machine wear has been experienced and the machine stands up very well." It is also interesting to note that the work is supported on the tail stock by a live center having a #6 morse taper shank.

Axelson lathes are built to stand up to this heavy type work and at the same time will produce to precision tolerances day in and day out. It will pay you to look to Axelson for recommendations on turning problems whether they are heavy duty, high production, or precision. Your welcome request for assistance is without obligation.

Write for literature describing Axelson Heavy Duty Lathes, models B-16", W-20", D-20", E-25", F-32", Precision Tool Room Lathes models 16, 20, or any of the models shown below. 6146 Boyle Avenue, Los Angeles 58, California.

PERFORMANCE DATA

Part	300-Ton Drill Hook
Machine	Axelson 25" Heavy Duty Lathe
Number of Pieces	3 per lot (one of 12 sizes)
Material	S.A.E. 4140 Forging weighing 800 lbs.
Hardness	311 Brinell
Depth of cut	3/8" to 7/8"
Greatest Precision	+.000,—.006
Tool Material	Kennametal 17° lead angle. Tool is set on its side for a 17° negative back rake and 7° positive side rake. The tool post is turned for a 10° lead angle.
Feed	.033" per rev.
Speed	207 SFM
Floor to Floor Time	Approximately 3 hours.
Note	Formerly H.S.S. cutters were used.

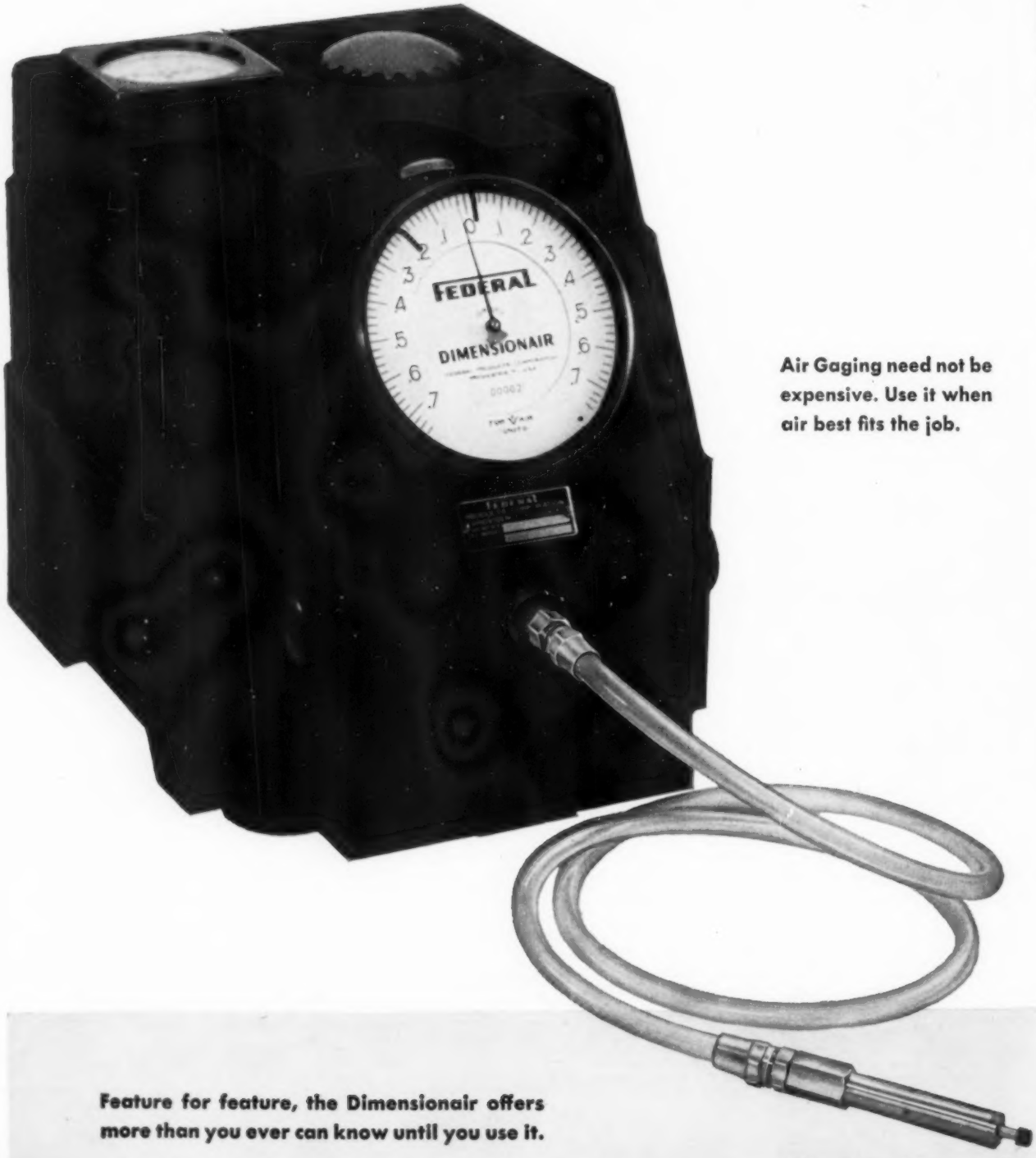


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If you find your gaging requirements are best met with AIR GAGES, it's to your best interest to investigate the simplicity and economy of FEDERAL Air Gages.

For instance, any of the regular air gage attachments can be used on the same Dimensionair without complicated adjustments. Such attachments as air plugs, rings, AirProbes, adjustable bore gages, air snaps, and all special designed attachments are readily interchangeable on the same air gage—and you need only one master. Moreover, when YOU REALIZE THE REASONABLE COST OF THE DIMENSIONAIR AND ITS ACCESSORIES, and when you realize the economy of maintaining and adapting it to any future need, the true economy of the Federal Dimensionair becomes strikingly apparent.

And remember, with the Federal Dimensionair you get THE REALLY EXCEPTIONAL FEATURES not available in other air gages —longer measuring range per magnification, greater plug clearance and longer life, deeper and larger jets, direct reading accuracy, and stable performance. Ask any man who has used both the Dimensionair and other air gages. *He* ought to know! Ask us about the low cost of air gage equipment. FEDERAL PRODUCTS CORPORATION, 4198 EDDY STREET, PROVIDENCE 1, RHODE ISLAND.

Ask **FEDERAL**

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Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting or Automatically Controlling Dimensions on Machines

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ENGINEERING

Bath engineers have a reputation for unusual skill in tap design and construction . . . due to a wealth of experience and to the necessity of solving almost every conceivable kind of a threading problem.

The answer to the tapping difficulty that is "bogging down" your production, may be a matter of record in Bath engineering files.

Check these facts!

To do the best job, Bath Taps are engineered

- to cut the material properly
- to be driven with minimum power
- to produce the correct size thread
- to give a smooth finish
- to take care of chip disposal

Bath engineers have found that a slight change in tap design, machine set-up or lubricant, will often improve thread quality and reduce production costs.

We welcome a chance at the "tough ones" . . . in fact, we are "eager beavers" when it comes to engineering assistance. Just give us the complete details.



Bath engineers check every detail, to see that all Bath Taps are conditioned to do the best threading job for your requirements.

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JOHN BATH & CO., Inc.

28 Grafton St., Worcester, Mass.

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Production Pointers from GISHOLT

GISHOLT TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

FINISHING LARGE AND SMALL DIAMETERS AT THE SAME TIME

Speeder-Operated Boring Bar Does the Trick

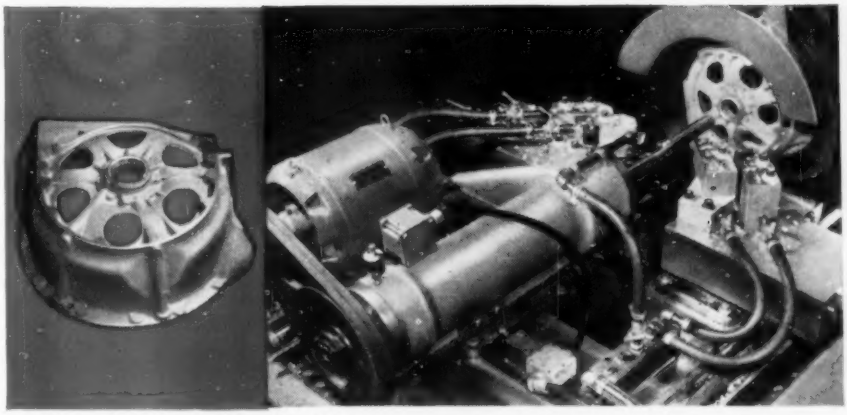
How to achieve both high speed and fine finish on these die-cast aluminum torque converter housings? Here's a nice example of production planning that does it!

This fast, two-operation job is done on a pair of Simplimatic Automatic Lathes. For the first side, the workpiece is clamped on the large flange face by means of an air-operated drawback fixture with location and drive from dowel holes in the flange. Tools mounted on the front and rear slides rough and finish face.

While the front and rear slides are working, tools on a special speeder-equipped, piloted boring bar mounted on the center slide bore and chamfer. Spindle speed is 500 r.p.m., and with the speeder operating, boring speed is increased to 800 r.p.m.—just the right combination of speeds for uniform finish on the machined surfaces. Time for this operation is under 1 minute f.t.f.

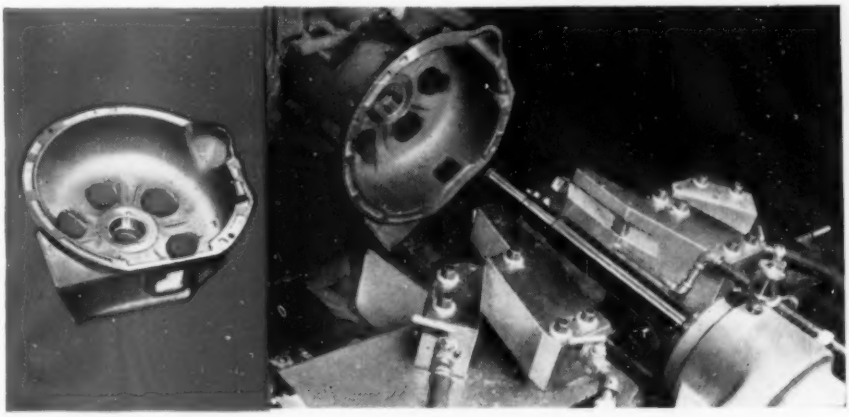
Same Operator Runs 2nd Machine

For the final operation, a special air-operated drawback fixture is also used, locating and driving from dowel holes in the large flange. Part is held against large flange face by clamping through three cored holes. There is a vibration dampener between the fixture and large flange face for quieter operation and prevention of possible chatter.



First Machine with special speeder-operated boring bar.

Second Machine also has special boring bar speeder arrangement.



Once again tools on the front and rear slides rough and finish face while tools on the special, speeder-equipped, piloted boring bar counterbore and chamfer. Again, time is less than 1 minute, f.t.f. One operator can easily handle both machines with hourly production totaling 48 completed housings at 80% efficiency.

Rotating the boring bar as well as the work provides correct speeds for machining all surfaces while saving time and achieving fine finish.

There's a great deal of interesting information in the pages of the Simplimatic catalog; also many helpful job reports. Write for your copy.

GISHOLT

TIME-SAVING IDEAS

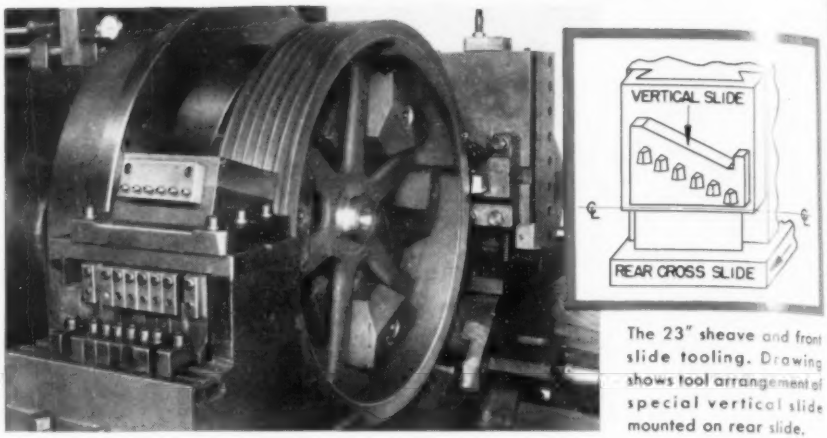
GOOD TIPS ON MACHINING SHEAVES

Novel Tooling on Fastermatic *Automatic* Turret Lathe

Everybody's looking for new ways to get speed and quality at lower cost! Aren't you? Here's a fine example of how you can do it in machining large sheaves.

The 23" diameter parts are handled on a Fastermatic Automatic Turret Lathe. All work on the hub is performed with standard tools on the hexagon turret—drilling, boring, reaming, facing and turning. Tools on a special back-facing attachment, operated through the spindle, face and turn the opposite end.

Of special interest is the unique method of machining the six grooves. First, tools on a special tool block mounted on the front slide rough out the grooves and chamfer the edges. Then, via a smart skiving operation, the grooves are finish-formed. This is done by six tools carried in a special vertical slide mounted on the rear slide. After the rear slide feeds in to a dead stop and holds up, the vertical slide feeds downward. Each tool is mounted slightly higher than the tool preceding it. One tool at a time cuts its groove as it feeds past the center line—assuring fine, smooth finishes with no distortion trouble.



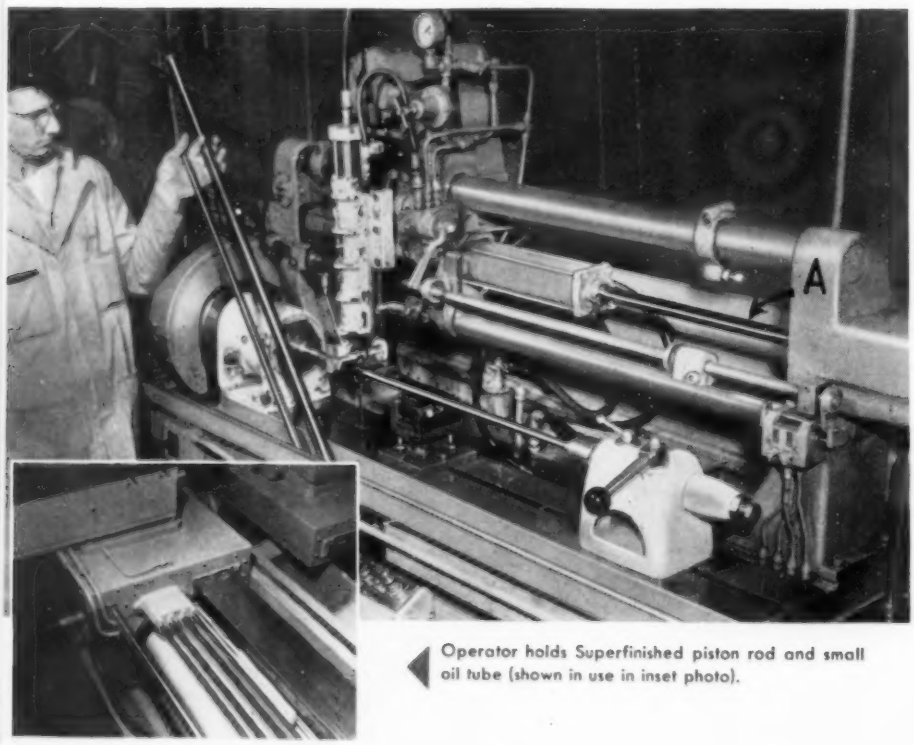
The 23" sheave and front slide tooling. Drawing shows tool arrangement of special vertical slide mounted on rear slide.

This novel single-tool method of finish-forming the grooves eliminates distortion to assure better finish. Automatic production cuts costs.

★ ★ ★

PUTTING AN END TO OIL SEAL PROBLEMS

Low-Cost Superfinish Means Better Operation—Less Maintenance



Operator holds Superfinished piston rod and small oil tube (shown in use in inset photo).

In more and more cases, Superfinishing is becoming a part of original specifications. Here it was specified to prevent oil seal troubles and provide more satisfactory and lasting service.

The smaller tube held by the operator is a telescoping connection carrying high-pressure oil to carriages and slides on Gisholt No. 24 Hydraulic Automatic Lathes. For a positive oil seal, the full length is Superfinished to 2½ to 3½ micro-inches from a ground surface of 20 to 30 micro-inches. The same is true of the large rod which is a hydraulic cylinder piston rod similar to "A" on this Superfinishing machine.

Superfinish removes all smear metal left from previous grinding operations. It also eliminates chatter marks and grinding flats which normally cause excessive packing wear and frequent servicing.

Low micro-inch surface readings are quickly obtained at little cost with this Superfinisher which does the job in a fast, automatic cycle.

GISHOLT

TIME-SAVING IDEAS

TH..Y WASTE NO TIME HERE...IN PRODUCTION OR CHANGEOVER

...17 Parts per Hour ...h No. 12 Hydraulic Automatic Lathe

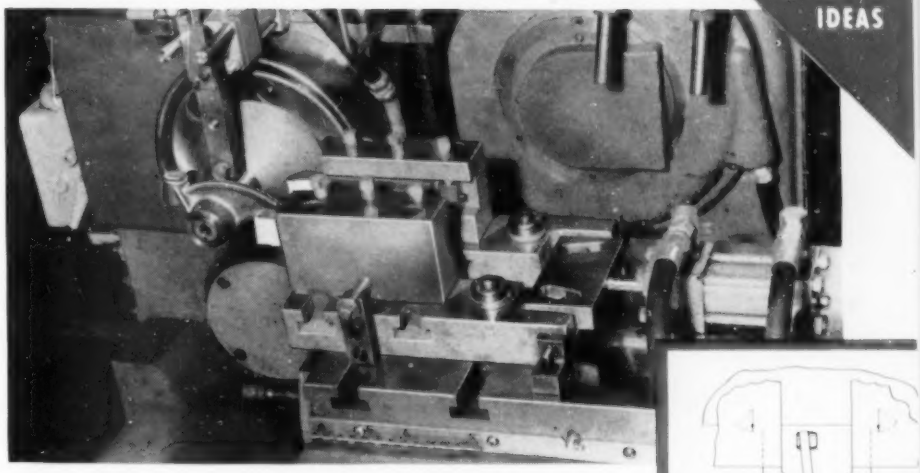
A simple enough machining job, this one. But it shows what can be gained by careful start-to-finish planning.

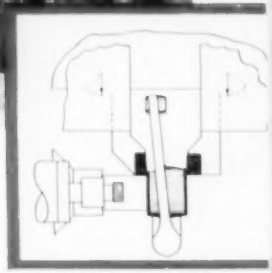
The problem is twofold—speedy straddle facing for these parts, and at the same time—fast, easy changeover for 13 different sizes.

The machine is a Gisholt No. 12 Hydraulic Automatic Lathe—a machine you can't beat for work of this kind. In this case, all work is done from the rear slide, leaving the front of the machine clear for extra-fast loading and unloading.

The workpiece is slipped on an air-operated expanding mandrel, locating from the face of the rocker web against an adjustable jack at the base of the air-operated retractable locator.

To start the cycle, the operator raises a single lever which chucks the part on the mandrel and retracts the locator which in turn actuates a limit switch starting the machine. The rear independent slide feeds forward with tools straddle-facing both hubs. There is tool relief at the end of the cut. Fast starts and stops are provided by the electric clutch and brake. Production is at a rate of 117 parts hourly at 80% efficiency.





Note that tool blocks pivot at end of cut, providing tool relief.

Below, typical parts handled by No. 12 Hydraulic Automatic Lathe.



As for swift, simple changeover, here's all there is to it: an easy sideward adjustment of tool blocks is made in T-slotted bases; the locator jack is altered and the mandrel is changed for size.

Nearly 2 parts a minute are produced here because of fast loading, starting and machining provided by the No. 12 Automatic Lathe.

Twenty-eight interesting examples of quality production of both simple and complex parts are pictured in the complete new No. 12 catalog. Write for it.

★ ★ ★

CAN THIS KIND OF BALANCING HELP YOU?

Workpiece is handled in overhanging position

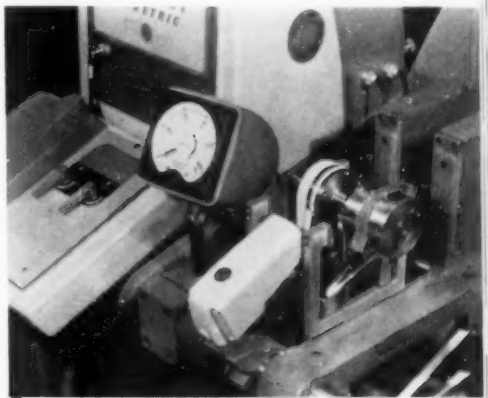
High-speed shaper heads used in woodworking must be accurately balanced. This eliminates vibration during operation, preventing "ripple" or "chatter" marks from marring molding surfaces.

This manufacturer of woodworking equipment solved his problem by dynamically balancing all shaper heads. To simplify and speed up the balancing operation, the Gisholt Improved Type S Balancer is used. With this machine, the workpiece can be balanced in an *overhanging* position—to make loading easier and faster. Correction is made by drilling radially to the indicated depth in the left and right correction planes.

Production balancing to fine tolerances is "everyday work" for Gisholt Balancers. Both large and extremely small amounts of unbalance can be accurately measured and located because amplification is infinitely variable. Bearing movements as little as .000025" are accurately indicated on the standard machine.

Two-plane balancing of these high-speed parts is made faster, easier by use of overhanging arbor.

DYNETRIC BALANCERS GISHOLT



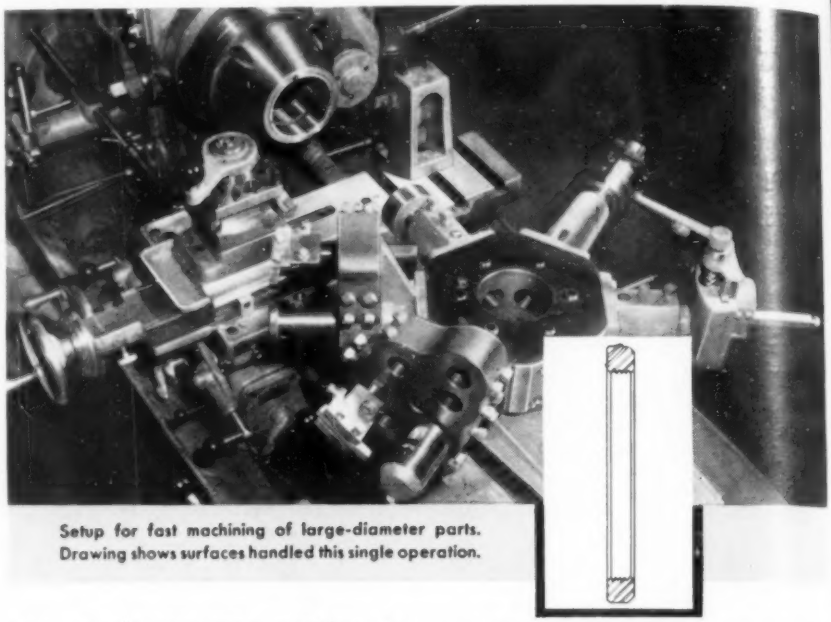
MODERN PRODUCTION BALANCING is one of many important subjects taught in the Gisholt Balancing School. Write for details.

GISHOLT

RAM TYPE TURRET LATHE DOES KING-SIZE W RK

TIME-SAVING IDEAS

Gisholt No. 5 Has Extra-Large Spindle Bore for Light Bar Stock, Tubing, Plastics



Setup for fast machining of large-diameter parts. Drawing shows surfaces handled this single operation.

It isn't often that ram type jobs call for a 4½" spindle bore. When sizes do get in this neighborhood, you may be able to cut costs even before the job is started. How? By proper selection of the machine.

This job illustrates the point. The large fuse liner nuts (and similar parts) are made from 4½" diameter seamless steel tubing. A Gisholt No. 5 Ram Type Turret Lathe was selected because it was available as a standard machine with a 4½" capacity spindle bore.

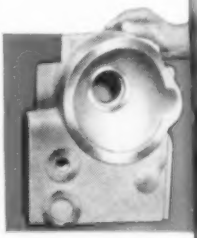
Machining the fuse liner nuts consists of facing, rough and finish boring and turning, chamfering, threading the I. D. and cutting off. Floor to floor time is 2.3 minutes.

The customer is really taking advantage of the faster, easier operation of this ram type machine. It has a hydraulic collet chuck and bar feed and a turret threading attachment. Even so, the cost is considerably below that of the larger type machine which usually handles this size work.

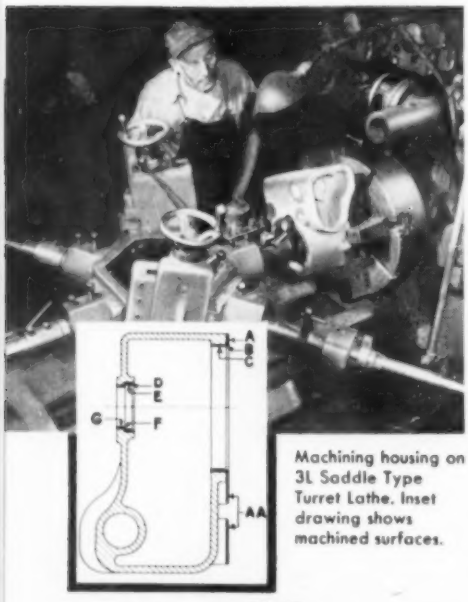
The first and most important step in cost saving here was in selecting the right machine for the job...the standard No. 5 Ram Type Turret Lathe with 4½" spindle bore. From then on low costs were easy.

★ ★ ★

REPETITIVE ACCURACY MADE CERTAIN THIS WAY



Dial Indicator on Saddle Type Turret Lathe Gives Visual Check



Machining housing on 3L Saddle Type Turret Lathe. Inset drawing shows machined surfaces.

What's the best way to maintain close tolerances in machining these awkward cast iron housings? This struck us as a pretty good answer.

Using a Gisholt 3L Saddle Type Turret Lathe, the large irregular-shaped workpiece is held in a 4-jaw independent chuck. Three diameters —*C*, *E* and *G*—are step bored and *D* is chamfered by tools mounted on piloted boring bars. The distance between face *A* and the base of co-bore *F* is closely maintained, and a visual check of machine accuracy is provided by the dial indicator mounted on the finish boring bar. Line boring assures concentricity and permits holding close tolerances, part after part.

While boring takes place, tools on the square turret are used to face the front plate surface *A*, three bosses, *AA*, and chamfer *B*. Simultaneous use of tools on the hexagon turret and square turret shows there's time being saved . . . an easy matter with the full-swing side carriage and cross-slide features of the Gisholt Saddle Type Lathe.

Good chucking, good tooling with special attention to accuracy aided by a dial indicator assures a good rate of production with uniformity.

No. 7-854

627

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.



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what's so different about

Piercing Color TV Chassis?

Color TV chassis are produced in small lots—require frequent engineering changes—setups and production tools are high cost operations.

THE WIEDEMANN RA-41P TURRET PUNCH PRESS economically produces chassis and panels in small lots for

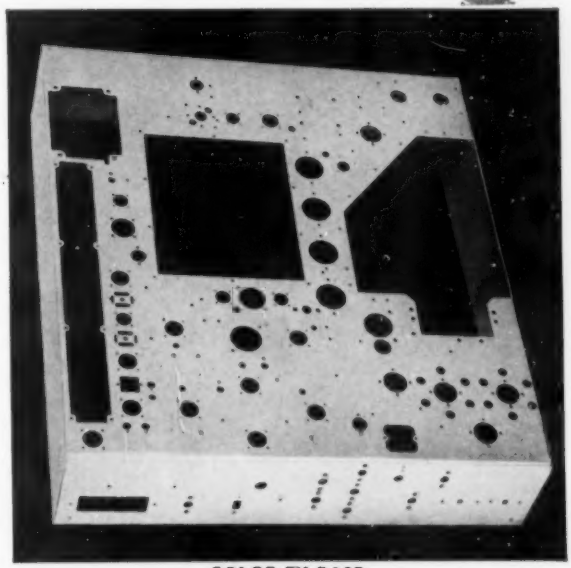
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and many other applications

because:

- **Setup time is low**
- **Initial tooling cost is low**
- **Punches and dies are re-used on other jobs so tooling cost soon becomes a negligible factor**
- **Engineering changes are accomplished without delay to production schedules and at low cost**
- **Complete flexibility—close hole centers—20 hole sizes in sheets to 28" x 40" in single handling —40 to 60 holes per minute located to plus or minus .005" tolerance**

These advantages combine to make the RA-41P Wiedemann Turret punch press a paying investment to all chassis fabricators, since the RA-41P is the only machine designed for economically piercing electronic chassis and panels in low runs.



COLOR TV BASE
Quantity 55
(Pierced on Wiedemann RA-41P)
530 strokes of press
31 different punches and dies used
(no special tools)
2 handling operations
TOTAL TIME (floor to floor)
per piece 16.25 MINUTES

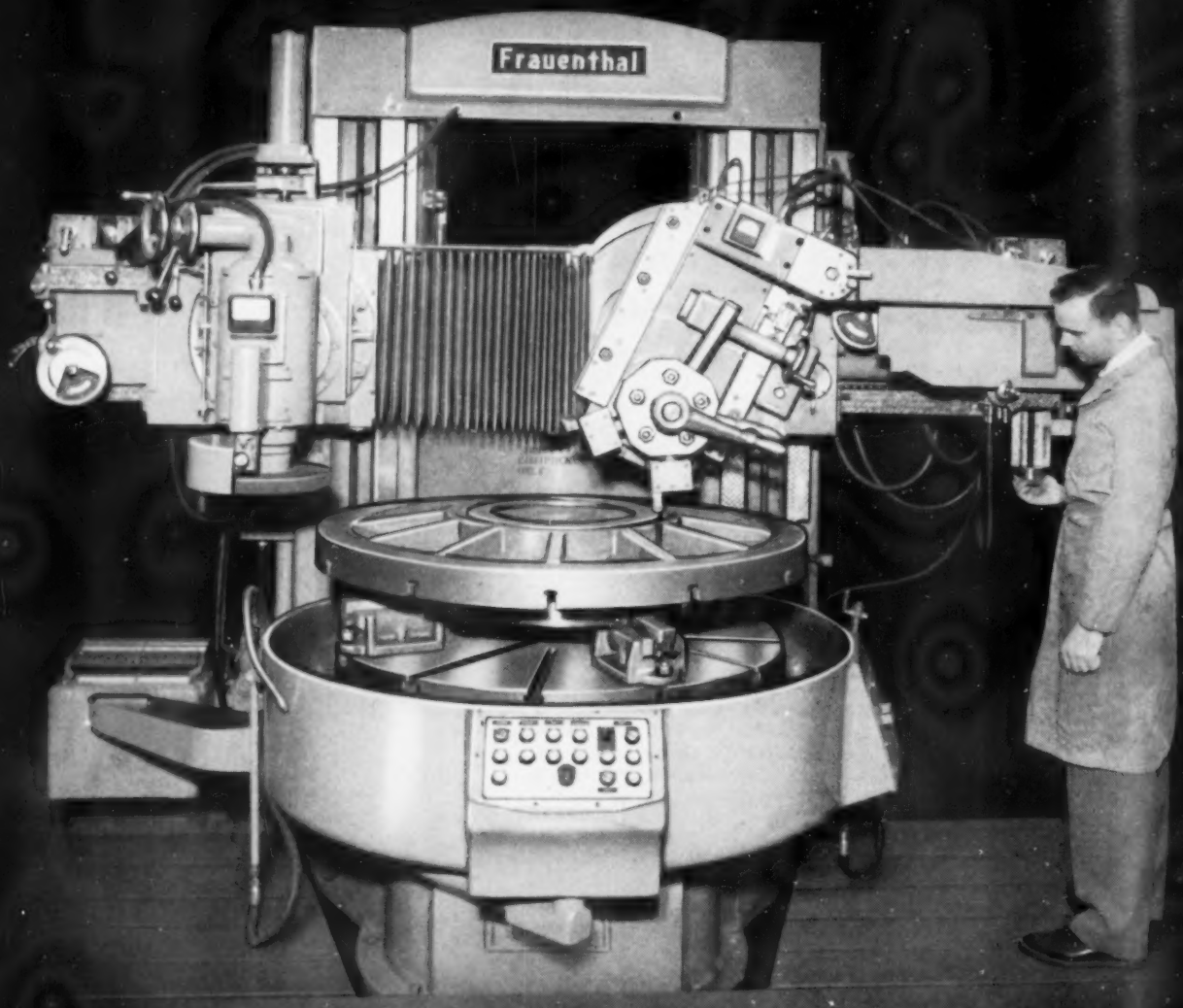
Write for a copy of Bulletin 241

WIEDEMANN MACHINE COMPANY

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announcing...



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NOW AVAILABLE FOR THE FIRST TIME — here's a machine specifically designed to perform finish turning and ultra-precision grinding operations. With it, you can produce accuracies previously considered impractical, with assured concentricity of related surfaces finished on a one-setup basis!

Originally designed to meet the exacting requirements of jet engine production, the Series 3100 machine is completely new from the ground up. Its unique design opens up new possibilities for machining large work-piece, close-tolerance jobs on a mass-production basis. The Series 3100 offers the entire metal-working industry exceptional new capacity for precision turning and precision grinding.

CHECK THESE IMPORTANT FEATURES

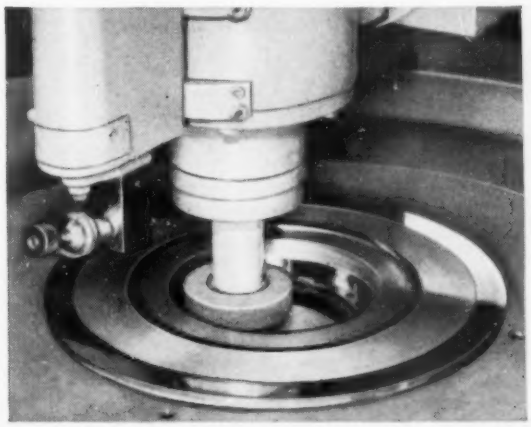
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- Hydraulically actuated grinding slide
- Hydraulic grinding spindle
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... AND THIS OPTIONAL EQUIPMENT

- Hydraulic tracer control
- Electronic surface speed control
- Hydraulic wheel dressers for varied applications



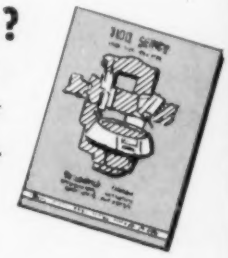
Here, the operator uses a Series 3100 machine to bore out the inside diameter.



This closeup shows how the machine performs close-tolerance finish grinding of the workpiece's top surfaces and inside diameter.

May we help you?

If you'd like to have details on how the Series 3100 can offer you new tool room or production benefits — our engineers are at your service. Write for informative bulletin No. 301.

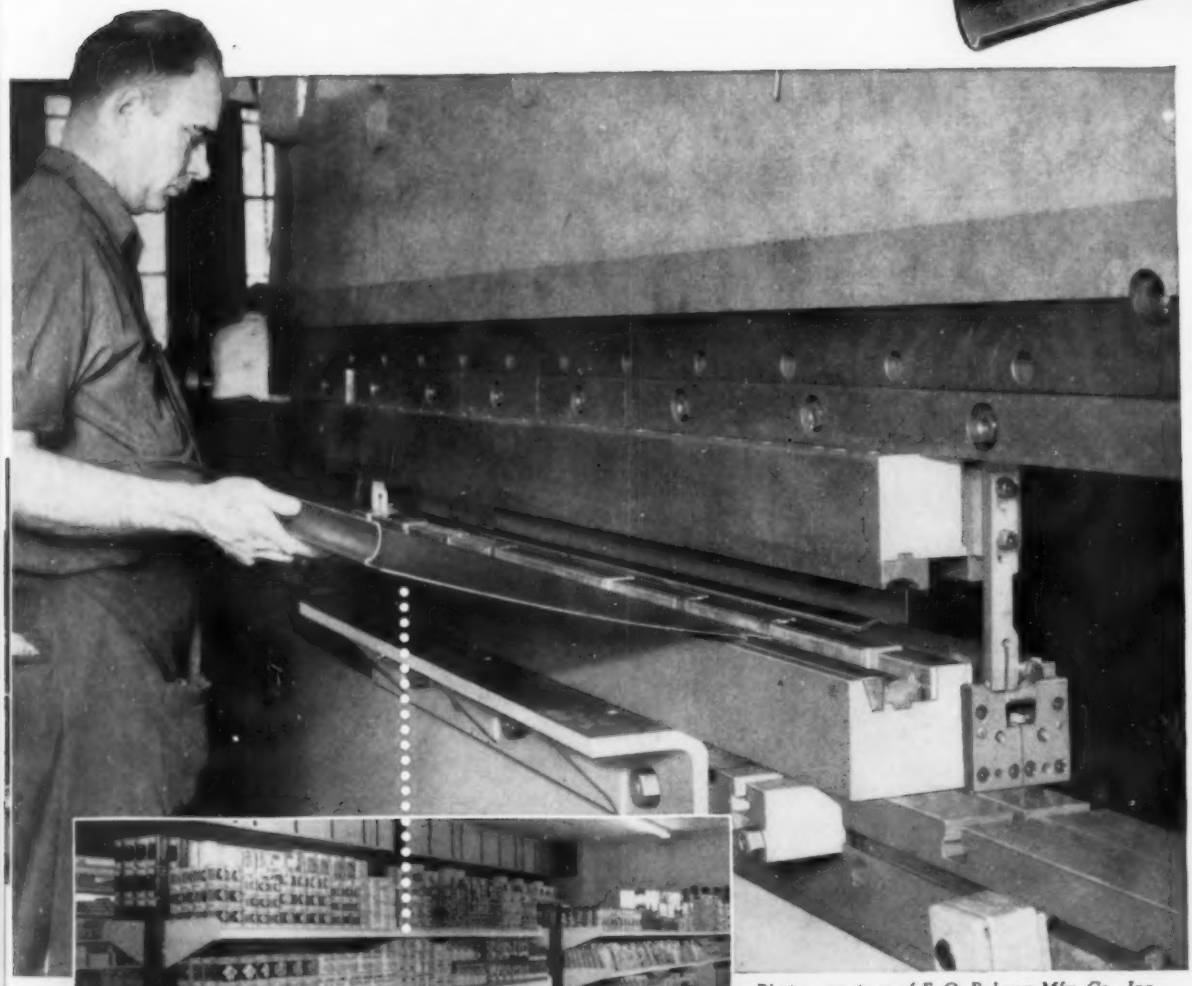


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Photos courtesy of E. O. Bulman Mfg. Co., Inc., Grand Rapids 2, Michigan.

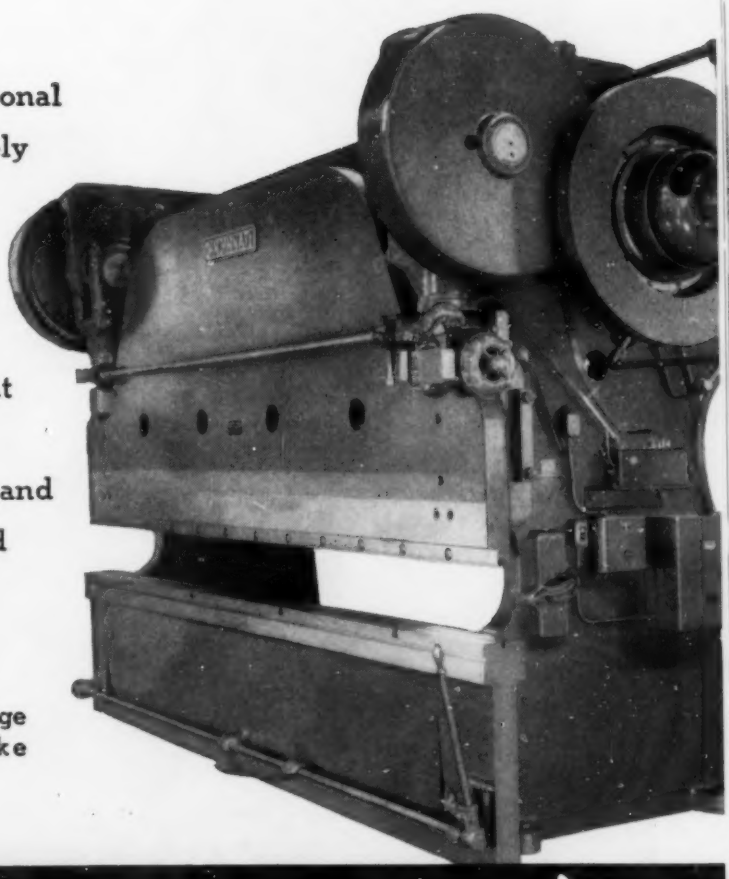
Note the clean straight lines of the moldings formed on the Cincinnati Press Brake.



...could solve this problem

The long steel shelves of these sectional display racks are formed so accurately that sections match perfectly with lines straight and clean.

The Cincinnati Press Brake is forming to such close tolerances that a masking strip previously used is eliminated. A production increase and no discards has materially reduced costs while product was improved.



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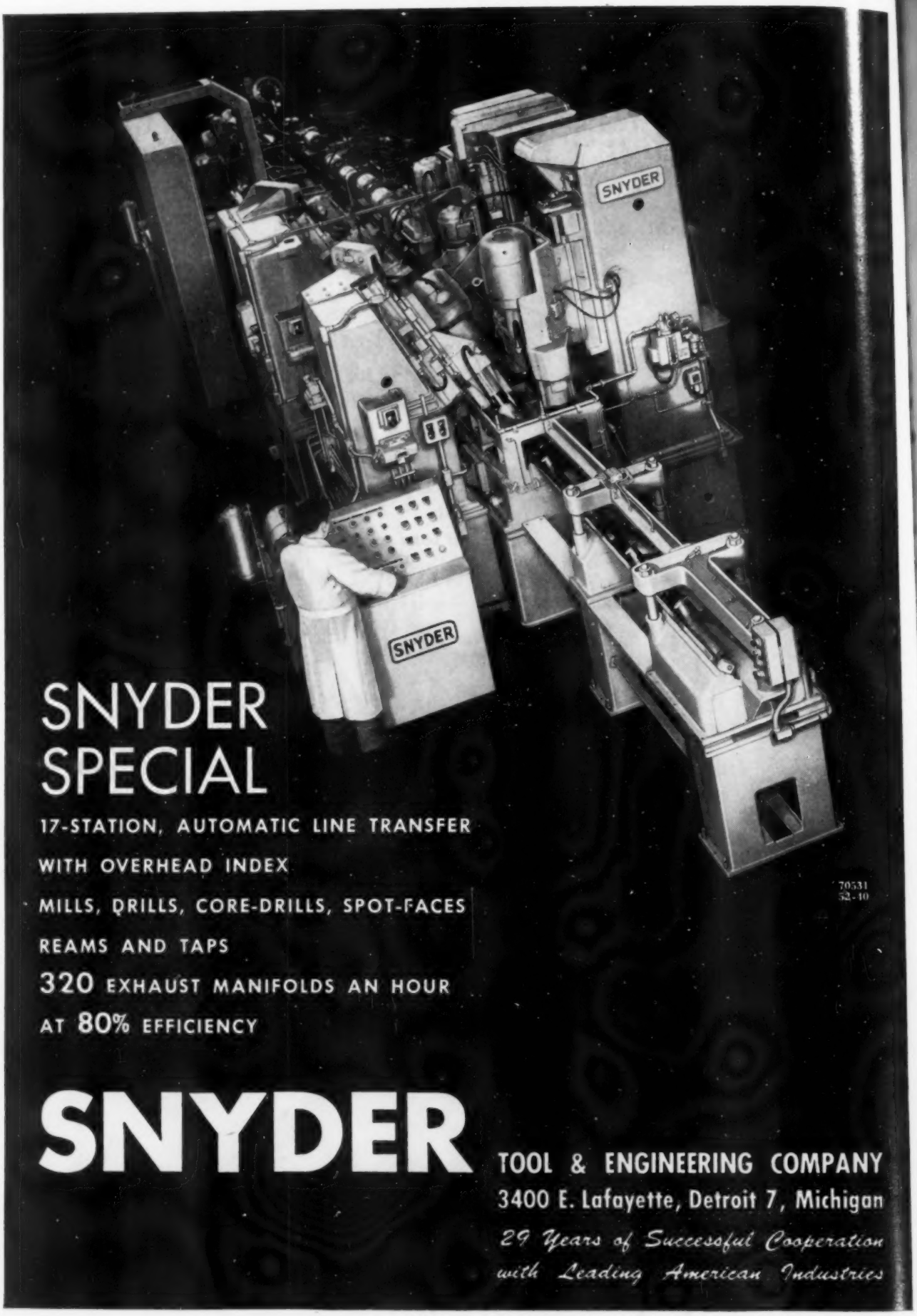


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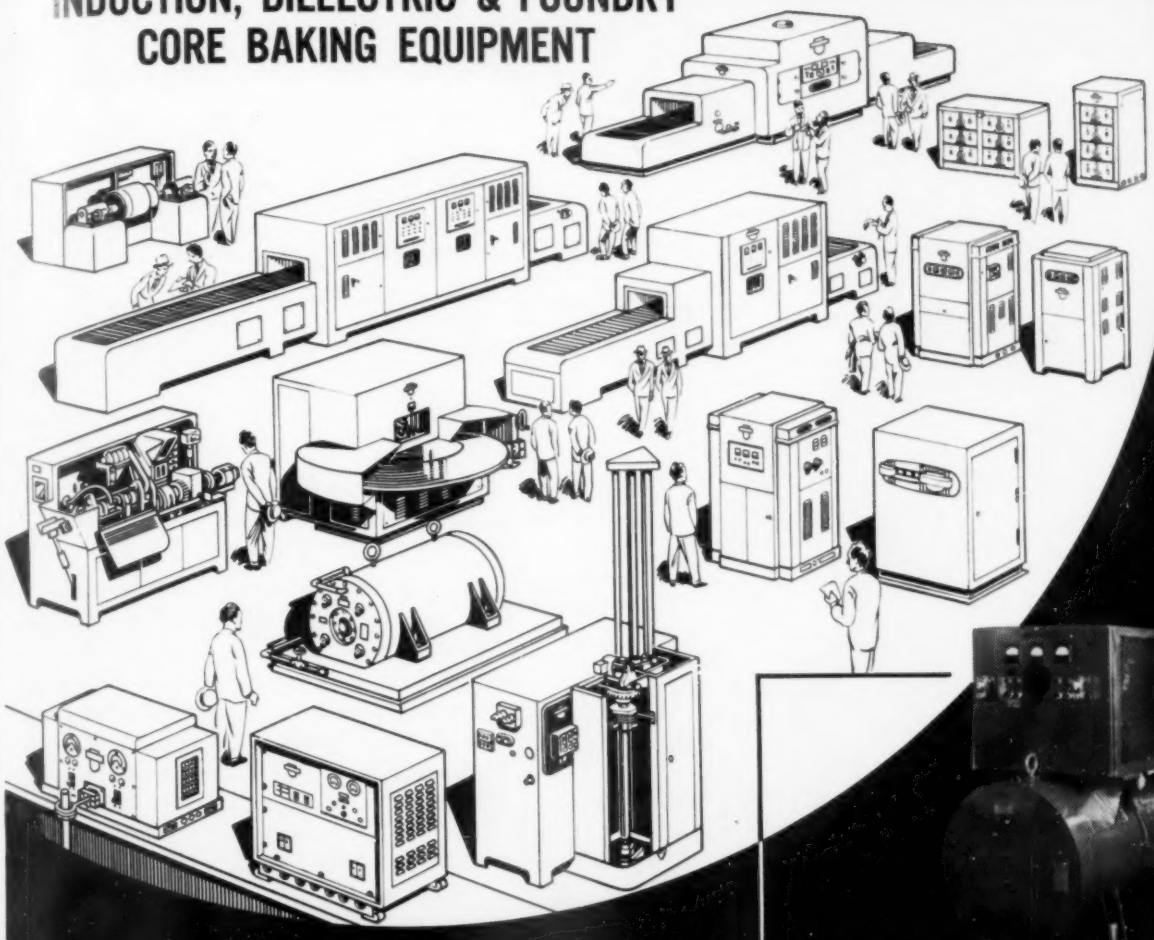
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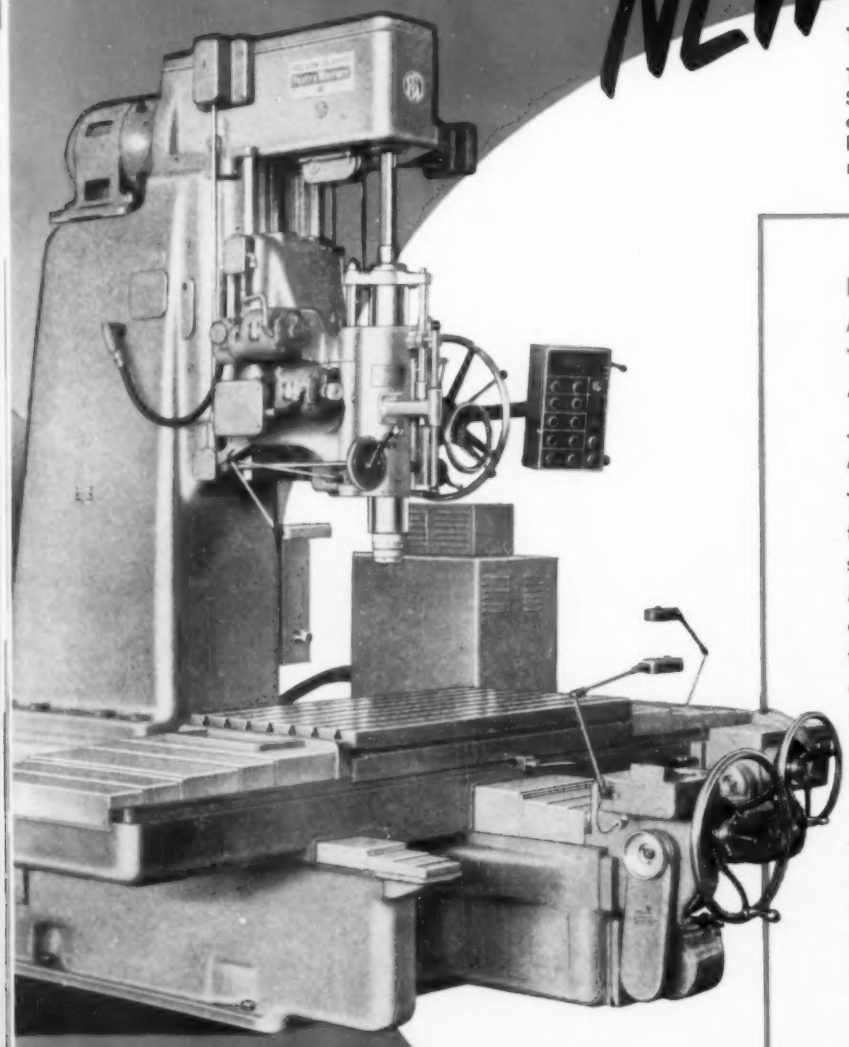
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Table Working Surface: 28" x 56"

This latest addition to the Pratt & Whitney Electrolimit Series augments this famous Jig Borer Line. With ample capacity for all but the largest jobs, the Number 3E is a powerful machine that handles a wide range of work sizes with speed, ease and efficiency.



BRINGING YOU THESE IMPORTANT ADVANTAGES OF ALL P&W ELECTROLIMIT JIG BORERS . . .

"TENTHS" ACCURACY EASILY, POSITIVELY . . . *with the exclusive P&W Electrolimit Measuring System*

This method of locating the table is extremely fast, accurate and simple to use. Basic 1 inch spacings are obtained ***electromagnetically*** from solid master bars; there are no contacting surfaces; possibility of lost accuracy through wear is eliminated. Fractional inches are obtained by means of an easy-to-set, precision micrometer screw reading direct to .0001 inches. . .

PRECISION PRELOADED BALL ROLL QUILL . . . *Retains Initial High Precision Indefinitely*

The hardened, ground and lapped spindle "roll-feeds" in a preloaded ball roll mounting. "Tenths" accuracy is maintained indefinitely. Unlike plain bearing type quills, no maintenance or adjustment is required.

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Provides far greater speed and ease in handling than is possible with two-column construction.

TELESCOPING GUARDS... protect carriage and bed ways.

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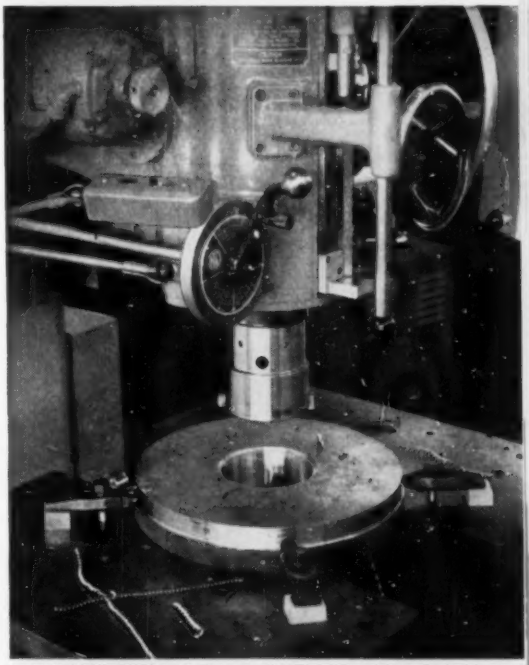
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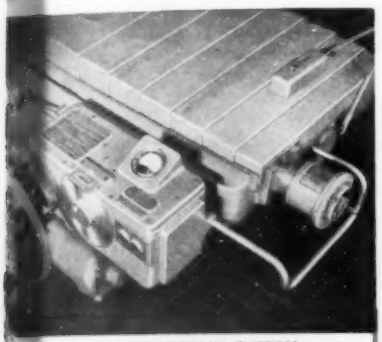
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THE P&W DOUBLE BIT BORING BAR

Specifically designed for fast, accurate production boring, the two carbide bits provide a "balanced cut" that enables the Number 3E to make use of its full horsepower for rapid metal removal when machining tough alloys. Up to 1/2" of metal can be removed per revolution, with each bit taking off 1/8". For maximum rigidity, the DOUBLE BIT BORING BAR *screws directly* onto the spindle nose.

FOR *Added Versatility*

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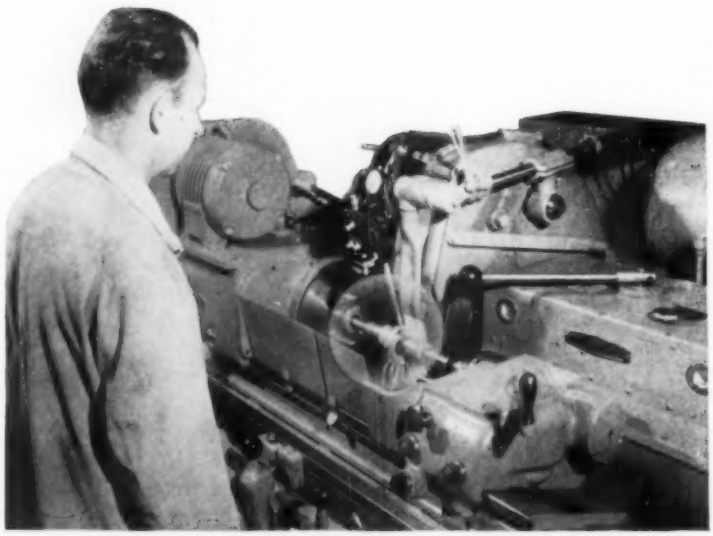
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Users praise "TOUCH of GOLD" *performance that steps up production rate and quality while cutting costs*



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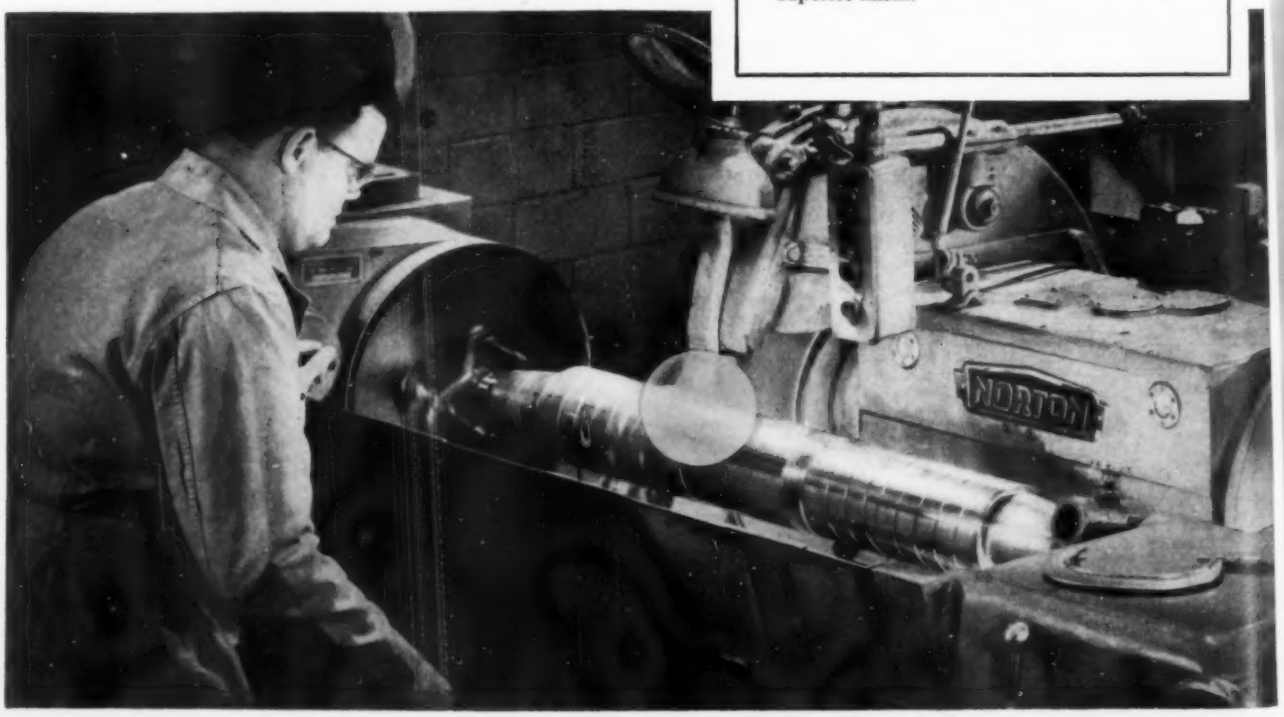
Users' Reports on Cylindrical Grinding

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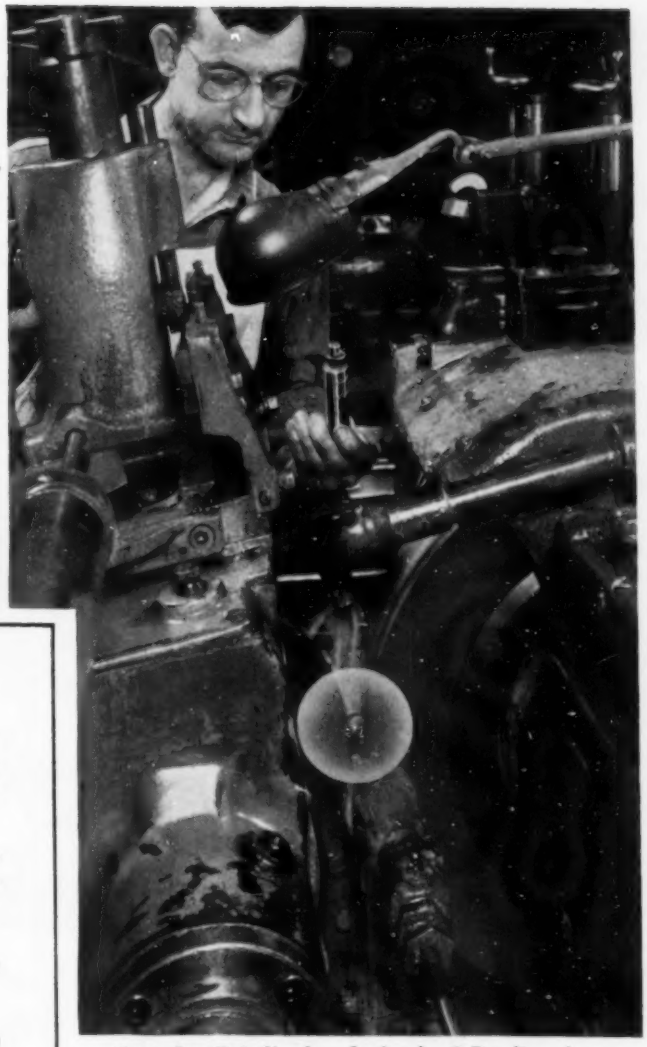
Job: Rear axle pinions, SAE 4120 stock.
Report: Grinding to .001″ limits, G Bond wheels removed stock faster, more uniformly. Gave more pieces per dress, with less spark-out time.

Job: 3″ diameter formed roll, hard steel.
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Users' Reports on Centerless Grinding

Job: ¾" diameter x 2" textile spindles, spindle steel.
Report: G Bond wheels produced better form and finish than any other wheels. Gave 50% more pieces per dressing on both rough and finish grinds. Also eliminated previous distortion of spindles due to overheating.

Job: Removing up to .010" per pass on varied steel parts.
Report: Dressing required only once every 4 hours, instead of every 40 minutes. Best general purpose wheel ever used on our centerless machines.

Job: Thru-feed ½" diameter bar stock, stainless steel.
Report: Cut faster and freer, held size better and gave better finish than previous standard wheel.

Job: ½" diameter shafting, drill rod and stainless steel.
Report: G Bond wheel gave 16 hours longer wheel life and produced much better finish.

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The Tool Engineer

Futures Unlimited

We have been hearing a great deal lately about a recession and to the unemployed a definite depression is in effect. It is significant, we believe, that the tool engineer today does not feel the recession. The want ads are still asking for more tool engineers. Ours is one profession that is not overcrowded. There just aren't enough tool engineers to go around and this condition will not improve in the immediate future.

The tool engineer is the man who properly applies the tools that multiply man's efforts and it has been by the proper application of tools that this country and Canada have achieved the highest standards of living the world has ever known. Our civilization today is too demanding to allow a depression for tool engineers.

Management realizes that it is the tool engineer who has the answers to every production problem. He is the keystone of the production organization, and therefore, is assured of a position as long as we continue our struggle for world leadership.

The tool engineer has an obligation to our welfare, however, and that is the improvement of his engineering knowledge. This must be a continuing effort throughout his life and benefits him as well as the society in which he lives.

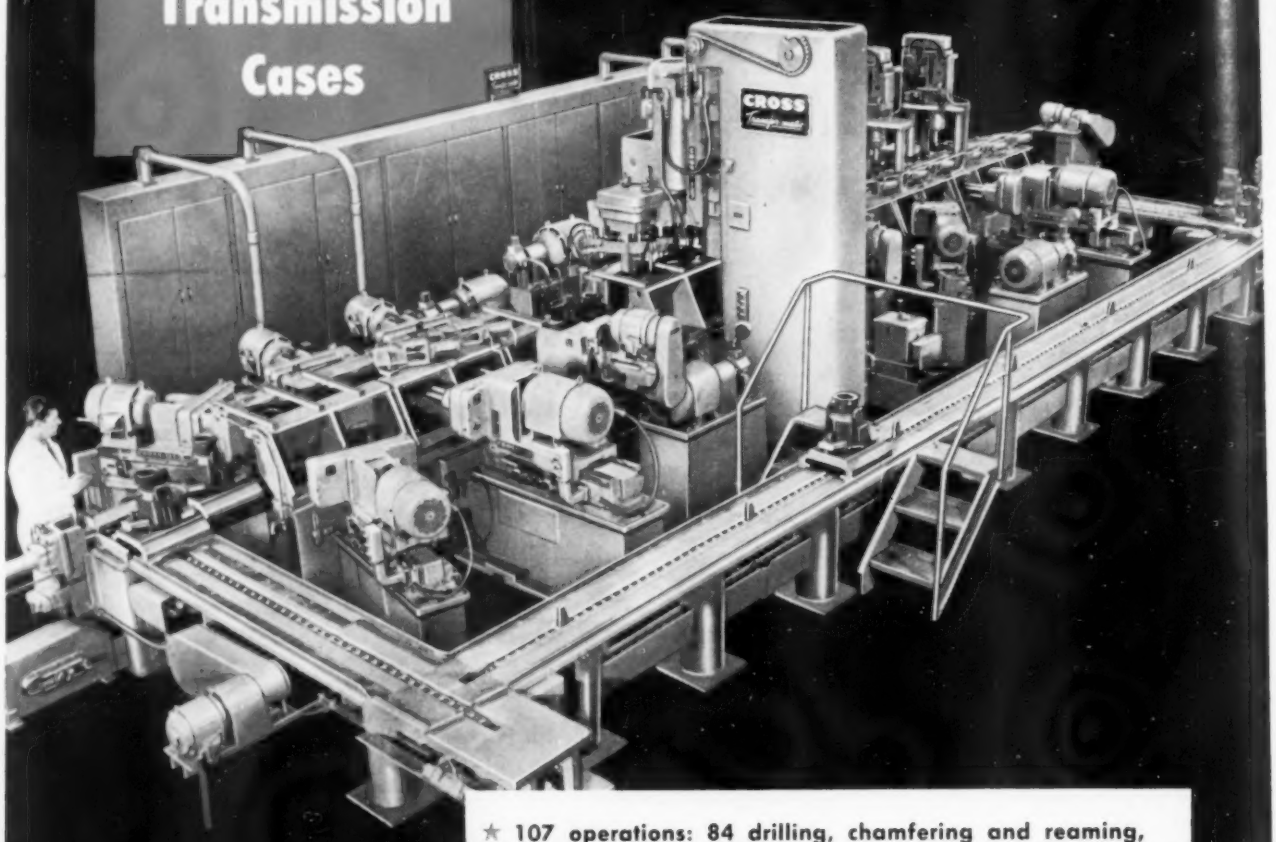
The American Society of Tool Engineers endeavors to make this knowledge easy to acquire by continually finding ways and means for the tool engineer to improve his education. We believe perhaps this is the reason for our being the fastest growing technical society in the country today, with the reputation of being a live-wire organization.

Joseph P. Crosby

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single-spindle automatics

solve production problems

By Marvin H. Palm

Division Superintendent
Air Brake Div.
Wagner Electric Corp.
Edwardsville, Ill.



WHEN the Air Brake Div. was moved from St. Louis to Edwardsville, to make room for post-war expansion of operations at both cities, two interlocking problems were encountered. It was necessary to expand both the production force and the machine facilities.

Because of the large number of types of products manufactured and because of their intricacy, Wagner has always used a labor force comprising self-reliant men with years of experience. Edwardsville did not have an available force of such men.

Production at the desired levels of quality and quantity could be obtained by using experienced setup men and closely supervised inexperienced operators on such operations as drilling and milling by adding machines similar to those already in operation.

Because turning operations represented a large proportion of the jobs handled by the division, management was hesitant to just increase the num-

Fig. 1. Single-spindle automatic chucking machines produce precision jet engine accessories. Machines were chosen partly for their ability to hold close tolerances.





Fig. 2. (above) Usually one operator and one part-time setup man are required to produce industrial parts on four single-spindle automatics.

Fig. 3. (left) Bored bushing holes in jet part were temporarily machined in single-spindle automatics while waiting for delivery of boring machines.

ber of hand turret lathes used. Anticipated lot sizes ranged from 200 to several thousand pieces, which would not justify the use of multiple-spindle automatics. At this time, a new single-spindle automatic was introduced, the Warner & Swasey 1-ac single-spindle chucking automatic. After thorough study, two of these machines, *Fig.* 1, were installed because they apparently combined high production with flexibility.

These automatics have proved versatile and well suited to the manufacture of air compressor parts and intricate valves. Several operations are combined in one machine. Fine tolerances and classes of finish are not difficult to maintain even on medium-sized job lots because these machines remain in adjustment and setup time is short. Four automatics are now regularly used on industrial parts and another four are producing precise jet aircraft engine valves and accessories.

Output Increased: First operation turning costs for an aluminum application valve body were reduced 35 percent when the job was transferred from a Number 3 turret lathe to a pair of 1-ac automatics. When production rates are high enough to justify the use of three 1-ac's, the cost reduction is 52 percent on the basis of production increase alone. As many as three separate operations, previously performed singly on other machines, are now turned in one automatic operation because of

higher machine rigidity and possibility for simultaneous cuts.

Machine rigidity helped, for example, in the combination of two operations on an upper body for a foot metering valve. The part has a hole bored with an accuracy of 0.003 inch and a finish of 75 microinches, rms. Boring cuts are interrupted by six lugs in the hole. Former turret lathe and boring machine methods produced uncertain results.

Although some bored holes do not require close tolerances, they are held within limits for use as locating points to simplify subsequent machining. An eccentric ring, for example, has a central bore with a blueprint dimension of 0.505 to 0.510 inch. There is no difficulty holding the bore between 0.507 to 0.508 inch, thus making it usable as a locating reference for later operations instead of the more complicated and less satisfactory fixture reference formerly required. A ½-inch bored bushing hole in a jet part, *Fig.* 3, was held to within +0.0000 —0.0005 inch on the automatics while waiting for delivery of precision, automatic boring machines.

Fewer Operators Required: Automatics have eased the pressure on turning operations caused by skilled labor shortages. The four 1-ac's used for producing industrial parts are handled by one operator and one part-time setup man. Nine hand turret lathes with seven operators and two setup men would be needed to produce an equal number of the same part. The reduction in direct labor is 4½ to 1. Because automatics almost eliminate the human element in machine manipulation, an operator of average ability produces less scrap on the single-spindle automatic than a skilled man would on a hand turret lathe. Thirty percent of an air compressor control valve run, cut on a turret lathe, failed to be within tolerance and had to be reworked or scrapped. Most of the rejects failed because O-ring grooves were not properly cut. Recessing of some type is required on about 20 percent of the parts produced at Edwardsville and is more successful on the automatics.

Setup time is about the same when turning a rotor, *Fig.* 4, on either a turret or an automatic However, production time is saved by the automatic because the cutters that hold the outside diameter to ±0.0005 inch require less attention during the run on the automatic.

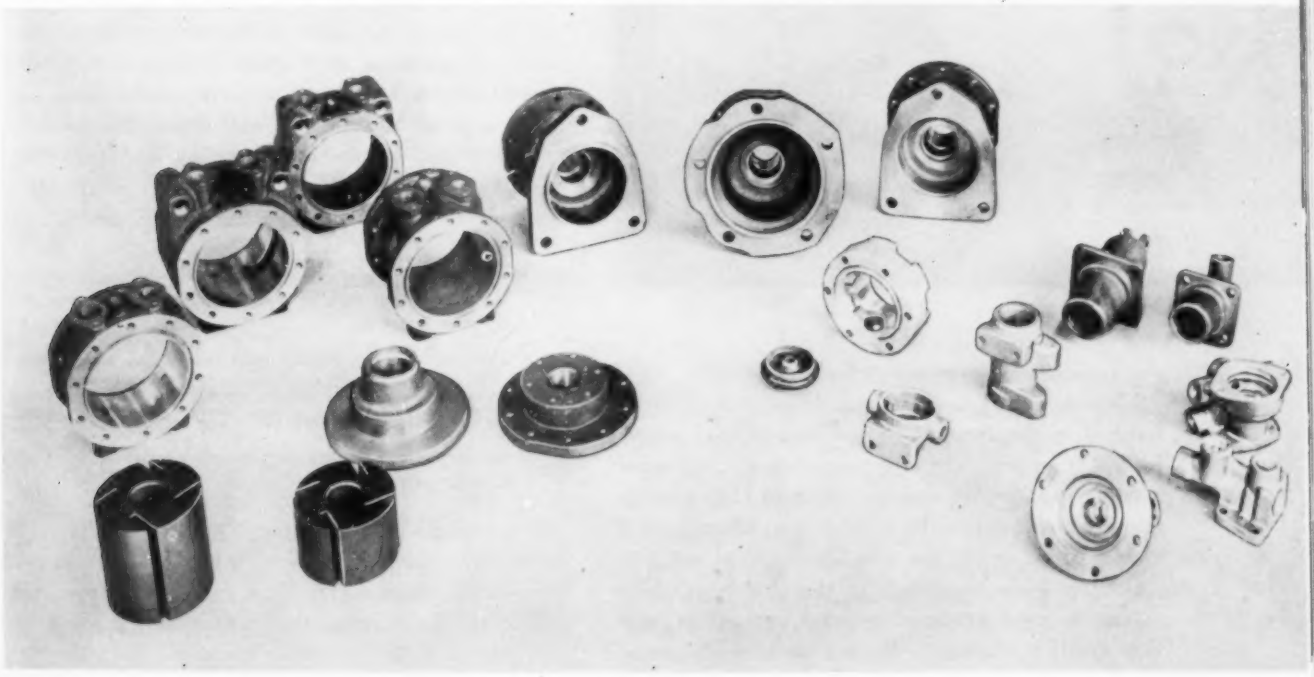
Precision jet engine parts, *Fig.* 5, are set up faster on an automatic than on a turret lathe. Complete setups on the automatic average from 5 to 6 hours, including tear down of the preceding setup and cutter sharpening.

Jet pump impellers with 2.450-inch outside diameters are held to within 0.0008 inch, and a total of 0.0005 inch on the shoulder depth. The following precautions are taken to accomplish this:

1. Coolant temperatures are carefully controlled and the building is air conditioned to give a work area temperature of 75 F.
2. Parts are held in a water bath between operations.
3. Fixtures are carefully balanced for maximum aluminum turning speeds.

Because of the accuracy of parts produced on

Fig. 4. Typical industrial parts turned on single-spindle chucking automatics. Rotor (lower left) is held to ± 0.0005 inch and must be taper-free for subsequent grinding operation.



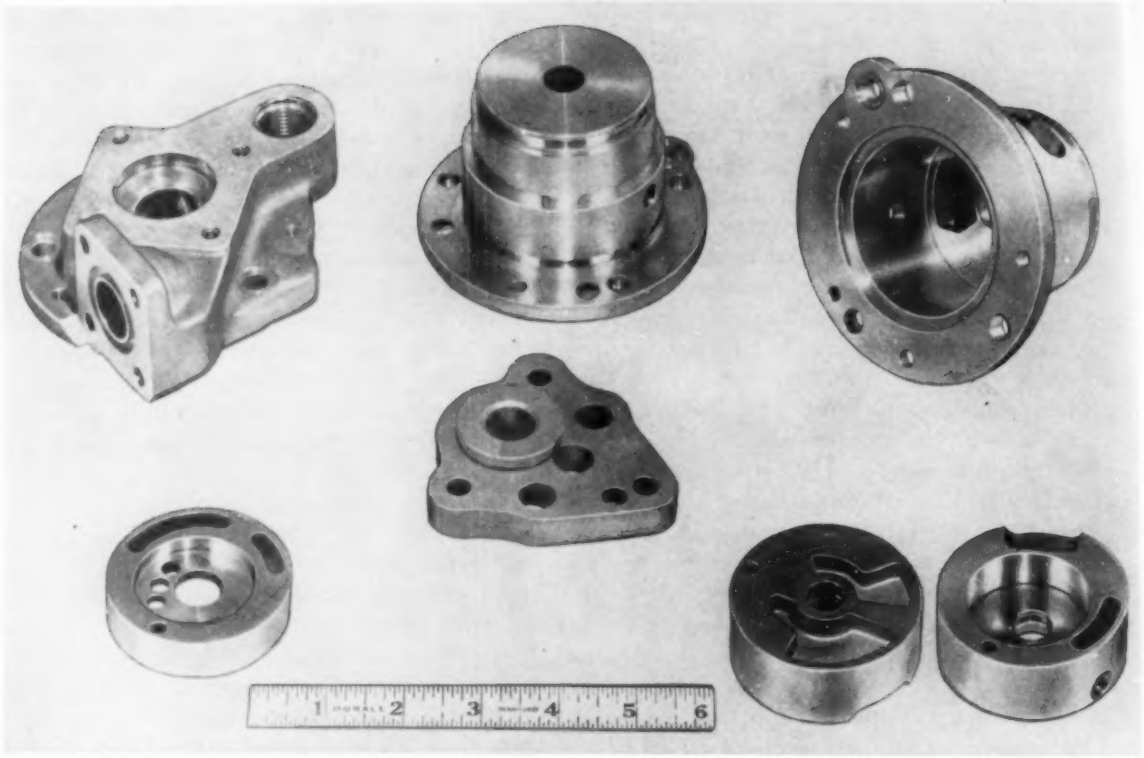




Fig. 5. (above) Jet pump components require close tolerances on size and finish. Automatics replaced a grinding operation by turning part (lower left) to within an 0.0008-inch tolerance.

Fig. 6. (left) Cooperation between all members of the production team contributed to the beneficial results from automatics.

the automatics, fewer are ground or bored.

Close attention to operating detail permits work finishes on aluminum to be maintained at 15 micro-inches, rms and virtually eliminates withdrawal marks. Specified finishes are achieved with a single roughing cut followed by a finish cut. About 0.0075 inch of stock is left per side for the final cut.

Cutting tools are carefully sharpened and kept sharp. A good grade of mineral seal oil is used as a cutting lubricant. Proper feeds and speeds, and the rigidity of the tool slides give turning cutters a life of 16 hours and up to 48 hours for wide form tools.

The beneficial results of the automatics on production problems at Wagner Electric would have been difficult to achieve without job preplanning, tool control and design, and teamwork between management, methods engineering and the shop, *Fig.* 6.

Benefits derived from the automatics are:

1. Greater output capacity.
2. Reduced scrap and, in many cases, more efficient production methods.
3. Transfer of more difficult jobs from other equipment.
4. Elimination of many subcontracted jobs and possibility for subcontracting work for other companies.
5. An efficient approach to the production of precision aircraft parts.

These single-spindle automatics also fit in well with the current inventory control program at Edwardsville. Because they can be efficiently used on short-run production, they are enabling stock to be reduced to an economic minimum.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Jig Layout Block

Welders found it difficult to hold accuracy when making lengthwise cuts on long pieces of pipe in jig building. They could establish a centerline mark on one end of the pipe, but when they tried to mark a similar point at the other end of the pipe, they had no means to insure that the two points, connected, would be in the same plane.

A unique V-block device was designed to lay out reference points on the pipe line in preparation for halving and quartering, attaching metal pads and other layout problems. Basically, the tool is an aluminum V, 4½ inches wide. An inexpensive protractor is mounted on a plate attached to one end of the block. A movable metal pointer is fixed so that it sweeps across the protractor, and a 2½-inch bubble level is mounted so that it moves with the pointer. A prick punch is inserted at the point of the V, in line with the 90-degree point on the protractor.

To establish a centerline on horizontal pipe, the V-block is placed on one end of the pipe, the pointer set at 90 degrees on the protractor, and the block adjusted until the bubble is centered. The punch is then struck to mark one end of the centerline on the pipe. The operation is repeated at the other end of the pipe, and the points connected with a straight edge if the pipe is short, or by popping a line, if the pipe is long.

To cut out a quarter-section of pipe, one line is drawn as before. To secure the other guide line, the pointer on the V-block is moved to 0 or 180 degrees on the protractor. The block is then slid around the curve of the pipe, which must be rigidly held, until the bubble again centers and the point is marked with the punch.

This procedure is repeated at the other end of the pipe to provide terminal points for the second guide line. The lines are exactly 90 degrees apart or one quarter-section of the pipe. The same procedure is used to half or otherwise section pipe lengthwise. The V-block simplifies accurately positioning pads on jigs of pipe. Attach points for the pads are located by centering the V-block bubble with the pointer registering the required number of degrees off the centerline. A stroke of the punch marks the spot where the pads should be placed.

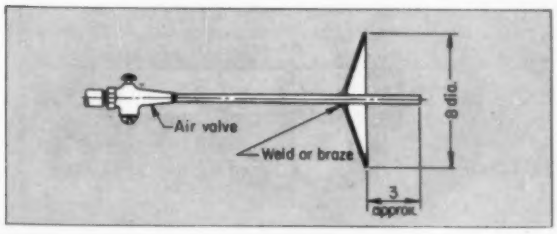
Charles Gonday
Dallas, Texas



—*Photo courtesy Temco Aircraft Corp.*

Chip Shield

Virtually every production machinist uses an air hose to blow chips and coolant from the work. Flying chips can cause serious injuries if not controlled. A simple yet effective method to prevent this is shown in the accompanying sketch.



A pipe about twelve to fourteen inches long is screwed into the end of the air valve. To this is welded a 20-gage sheet metal cone approximately 8 inches in diameter. The cone will deflect the chips away from the operator, especially if he is working in close quarters.

Roger Isetts
Kenosha, Wis.

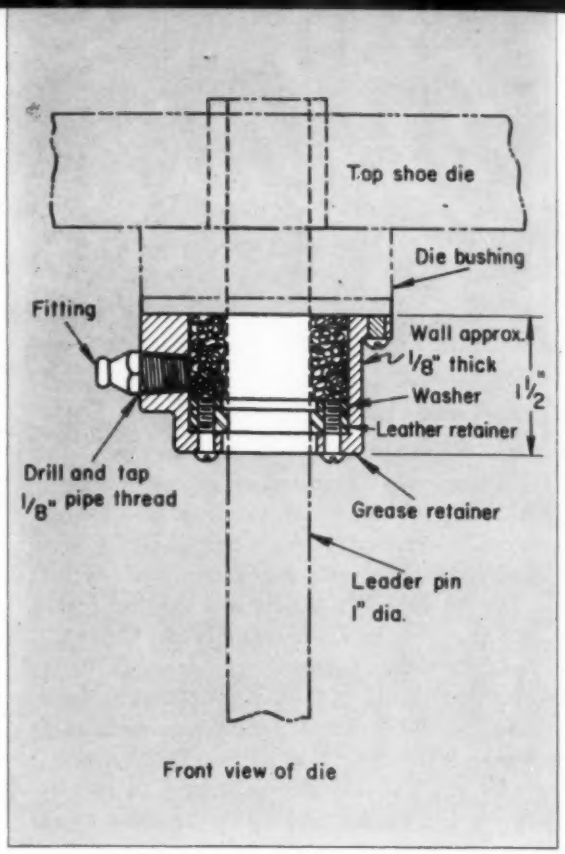
Grease Retainer for Leader Pins

The grease retainer shown in the accompanying drawing was designed to assure positive lubrication of leader pins on automatic dies fitted with hitch feeds. With these retainers ordinarily no attention need be given to lubrication after filling at the start of a run. The pins, running in a film of grease, are kept cool. Also the job is cleaner without the usual splattering of oil.

The retainers are light aluminum castings. Machine finish is required only for two surfaces. To hold the retainer ring, which may be punched out of leather, a standard $1\frac{3}{4}$-inch washer is drilled and tapped for 10-32 screws, to match three holes in the bottom of the casting. The hole in the washer is bored to $1\frac{1}{32}$-inch diameter for the 1-inch leader pin.

While the dimensions are given for 1-inch leader pins, they may be varied in proportion to fit other sizes. If desired, the grease fitting may be omitted as the retainer assembly can be readily dropped and filled at the beginning of the run.

Charles Spicer
Grand River Valley Chapter



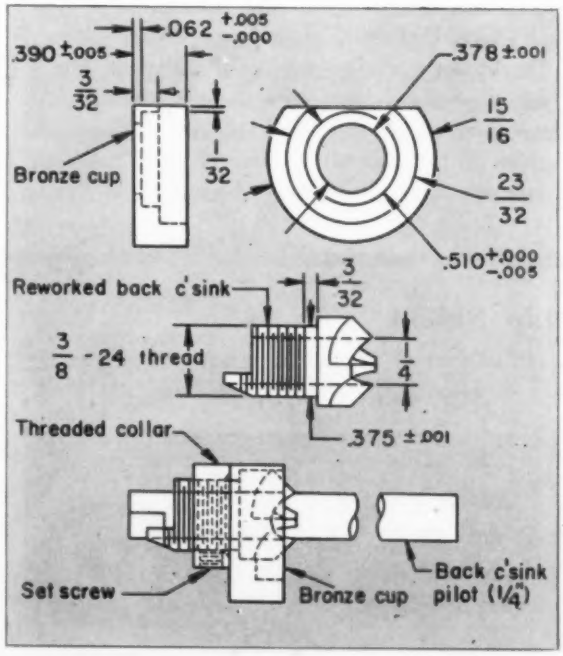
Adjustable Stop for Back Countersinks

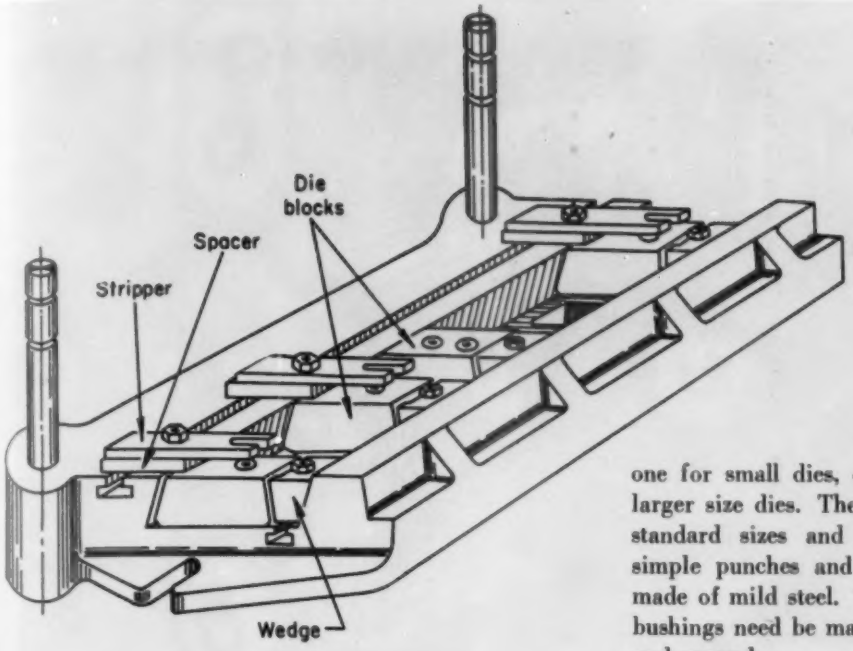
A neat trick, which stops a back countersink when a predetermined depth of cut has been reached, solved a vexing problem on an aircraft assembly line. The problem arose when countersunk bolts had to be installed from the inside of an air duct. Space limitations prevented the use of standard hand drills to perform the operation and angle drills were too difficult to handle. A back countersink was the only answer to the problem but those commercially available had their drawback, as there was no way of determining the depth of cut except by trial and error and this was time consuming.

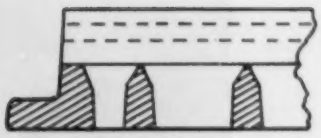
Commercial back countersinks were turned down and partially threaded. A bronze cup was made which fitted over the unthreaded section and part of the cutting edges. The cup was ground off, removing a segment to allow use of the tool in close corners. A threaded collar was made to fit the threaded section of the countersink. This provided an adjustable stop which was held in place by a setscrew.

In operation, the pilot is fed through the drilled hole from the outside. The countersink is placed on the pilot from the inside. As the countersink reaches its predetermined depth, the bronze cup rests against the underneath side of the work and the stop collar, preventing any further cutting.

H. M. Griffin
St. Louis, Mo.






Section of die-bed

Universal Die Set

When numerous piercing operations were to be performed, this universal press tool was developed to reduce the number of die sets required. The principle could also be adapted to other press operations as well, with considerable savings.

As shown in the accompanying sketch, the design consisted of a channel lower die shoe, into which standard size die blocks fit. Movable wedges hold the die blocks in position. The punch holder is of the same design. All punches and dies have the advantage of guideposts in this setup. The lower die bed is provided with openings (inset), allowing scrap to fall through. The ribs between the holes in the die bed have bevelled edges and sharp ends to prevent pieces from catching.

Three different sizes of the die set were made: one for small dies, one for medium and one for larger size dies. The small steel dies are made in standard sizes and hardened and ground. For simple punches and dies, the die blocks can be made of mild steel. Then only the removable steel bushings need be made of tool steel, and hardened and ground.

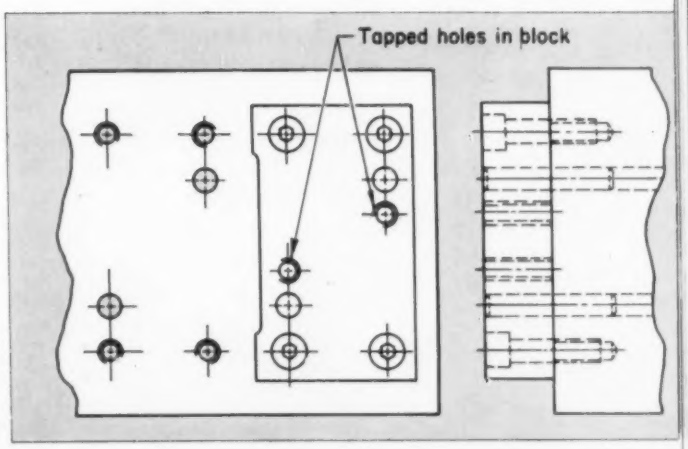
This universal die set is rapidly set up by simply sliding in the standard steel blocks to approximate position, then moving down the press ram slowly, with the punches fastened to the upper die holder. The die blocks are adjusted in the lower die holder until the punches enter the holes of the dies. The blocks are then clamped by tightening bolts on the bevelled wedges. The stripper plates and spacers are fastened by screws and can be slid along the T-groove as shown, for adjustment to fit the die openings. Several die blocks can be placed in the shoe and adjusted as shown. For intricate combination or progressive punches and dies, the die blocks are made of tool steel, hardened and ground, and the strippers, stops and other accessories are put directly on the dies.

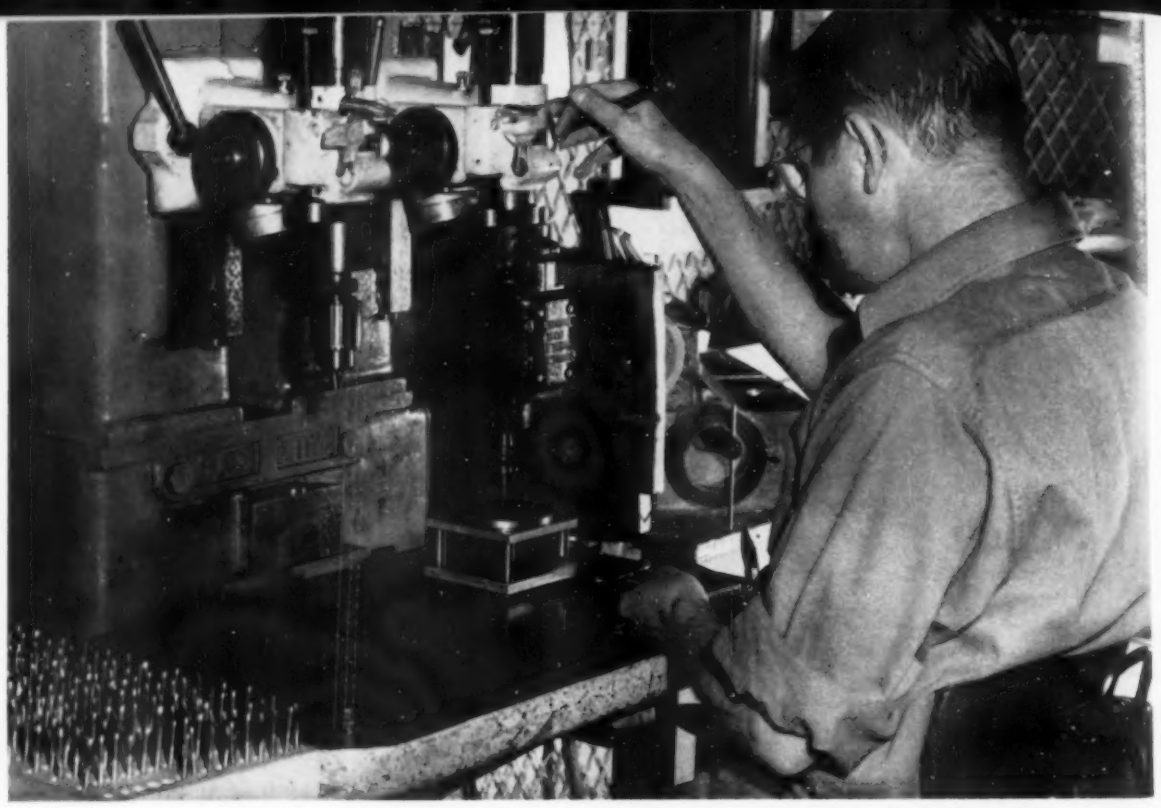
Hjalmar Dahl
Upplands Vasby, Sweden

Removing Fixture Details

Fixture details which are doweled in place are often damaged when they are removed. This is especially true when dowel holes are blind and dowels connot be driven out. Also fixtures which are made for the machining of two or more similar parts often have a stop or locator which must be moved. If tapped holes are added in the block near the dowels the block can be easily removed without damage to it or the fixture by jacking it up with screws inserted in the tapped holes.

Ernest Egger
Joliet Chapter





—Official U. S. Navy photograph

Fig. 1. Performance testing of small, fine thread taps on a standard drill press. Torque registering device attached to fixture indicates amount of torque required to drive each tap.

eliminating small tap troubles

By Harold E. Evans

Head of Tooling Division
U. S. Naval Ordnance Plant
Indianapolis, Indiana

TAPPING of small, fine series threads to close tolerances often results in failure. Production schedules can be interrupted by broken taps, and bell-mouthed and oversized threads may be produced. Because tapping is usually the final operation, unacceptable parts may result in scrap. Only after the operation is completed can the exact size and class of threads be determined.

Precision fire control equipment manufactured at the Indianapolis Naval Ordnance Plant is production tapped on drill presses equipped with sensitive, reversible type tapping attachments. Runs are short on various ferrous and nonferrous materials. Although material-speed charts were available to the operator, limits were difficult to maintain.

Incorrectly and inconsistently ground cutting angles were concluded to be the primary causes of tap failure. It was realized that poor tapping performance could result from a lack of adequate equipment for reconditioning and inspecting reground taps. To correct these conditions a tap standardization, maintenance and testing program was formulated.

For research and experimental purposes, drilling and tapping equipment, *Fig.* 1, duplicating that used in actual production, was installed in the tool grinding shop. It was known from experience that the prevention of oversized holes depended upon the operator's ability to avoid retarding or excessive tap leading while reversing the tap from the hole. A sensitive lead-screw tapping machine was used to avoid introduction of human errors. In addition, a coolant-equipped machine for grinding spiral

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points on taps was acquired, *Fig.* 2. It was necessary to modify this machine and other tap reconditioning equipment to obtain and duplicate established tap specifications.

A holding device was equipped with a torque wrench graduated in inch-ounces to hold the workpiece. A reading of the amount of torque required to drive each tap was then obtainable. By comparing readings for various conditions, the best face angle and chamfer for use with combinations of materials and coolants was determined.

In addition to providing an accurate torque reading when cutting, the special workholder also indicated conditions, such as chip wedging or tap dragging, during tap withdrawal.

Tests were confined to those materials frequently tapped in the production shop. Tap specifications were not established for each type of material because it would have increased tap inventories and produced identification, stocking and segregation problems.

Research was conducted to establish tap grinding specifications. Individual tap teeth were considered as single cutting tools to help visualize cutting action. Because only a small amount of coolant reaches the point of contact with small taps, spindle speeds were carefully considered. It was discovered that changes in hook angles caused only slight variations in torque. If one hook angle is consistently maintained in conjunction with other factors such as super finish of hook grind, true flute and chamfer index, a tap will give excellent performance in many materials.

Another factor established by experimentation was the importance of an exact chamfer relief angle. Too much relief may weaken the cutting edge and cause chipping. Excessive relief may also allow small particles of the material to wedge underneath when the tap is reversed, causing galling or tap breakage. Inadequate relief prevents free cutting, which may cause the tap to cut oversize. A smooth finish, especially on the hook, encourages shavings to roll uniformly and freely, and reduces driving torque.

After numerous trials, specifications for regrinding each size tap were developed as shown in the accompanying table. The trials also indicated that taps with hook-angle cutting faces were more adaptable to current needs than those with radial or rake angles. Two-flute, spiral point, concentric thread taps, ranging from 0-80 to and including $\frac{5}{16}$-inch dia. were adopted as standard. These are stocked in precision ground, 0-1, 1, and 2 tolerances.

Methods were established for inspection, handling, storage and perpetual reconditioning of taps. Because physical inspection of individual taps is time consuming and does not indicate the exact thread size each will produce, inspection by performance testing was established. The same drilling and tapping equipment, *Fig.* 1, used for the experimental work is used for inspection. After grinding, taps are performance tested in Grade 24 ST aluminum by cutting threads in previously drilled holes that allow approximately 75 percent of full thread. Taps were required to produce a thread size equal to the tolerances specified for the taps. Inspection operations are interchanged frequently between the lead-screw tapping machine and a drill press equipped with a tapping head. Uniformly ground taps produce consistent results on both machines.

Since it was established that a tap with certain cutting angles produces a certain size or class thread in a given material when operated at a specified speed with a particular lubricant, malfunctioning of taps in other materials or under other conditions, can be analyzed.

Taps that are returned to the tool crib by the operators are channeled through the tool grinding shop for reconditioning before reissue. A replacement stock of taps is maintained in the inspection area for direct exchange to the tool crib for dull

Fig. 2. The spiral point on a tap is ground on a standard grinder adapted for this purpose.



—Official U. S. Navy photograph

taps. This permits reconditioning a particular size tap in large quantities with a single machine setup. Taps are stored in wooden blocks, with holes drilled partially through to protect cutting edges and facilitate handling. The performance of new taps did not compare consistently to that of reconditioned taps, mainly because points were not ground uniformly, and new taps are now subjected to the reconditioning process before issue.

An additional advantage resulting from performance testing of taps is the psychological effect it has on the operators. Because they realize the taps have been tested and approved by performance, operators are careful to avoid any human element that might make the tapping operation a failure. Free-hand grinding and difficulties previously encountered in precision tapping have been virtually eliminated.

Specifications for Tap Reconditioning

Tap Size	Angle of Chamfer (degrees)	Length of Chamfer (threads)	Radial Relief of Chamfer 45 deg of Surface (inches)	Angle of Spiral Point (degrees)	Hook Angle of Spiral Point (degrees)	Radius of Spiral Point (inches)
0	9	4	0.0025	11	11	0.0175
1	10	4	0.0027	14	11½	0.022
2	10	4	0.003	14	11¼	0.026
3	10	4	0.004	14	11	0.0285
4	10	4	0.0035	14	11	0.032
5	10	4	0.0035	14	11½	0.0345
6	10	4	0.0045	14	11½	0 040
8	10	4	0.005	14	12	0.048
10	10	4	0.006	14	12	0.054
12	10	4	0.008	14	12	0.069
¼	10	4	0.007	14	12	0.073

Surface finish of hook—8 microinches maximum

Tumble-Plating for Man-Hour Economy

PLATING WITH TUMBLER EQUIPMENT has proved an effective innovation at Tempco Aircraft Corp. by chopping eight man-hours per shift from formerly required plating time.

In the past, small parts were arranged in wire baskets for their two-to-three minute dip in corrosion-resistant solution. Painstaking attention to spacing was necessary to prevent two parts from becoming moisture-sealed and to make certain that all surfaces got full exposure to the Alodine bath.

The tumbler improvement devised by Paul W. Green, foreman in aluminum processing department, keeps both parts and solution in motion, insuring thorough bathing of all surfaces. From the time parts are loaded into the tumbler and the tumbler door is closed, plating operation is entirely push button. Conventional crane control buttons are used to move the tumbler over the 40-foot Alodine tank and lower it into solution. An on-off switch actuates the tumbler motor to put the unit in motion. When the immersion time has elapsed, tumbler action is stopped, the crane and tumbler are moved clear of the tank and parts are unloaded for drying.

Unless the tumbler is submerged, it is never revolved since action would result in serious scratching of the plating.

The tumbler itself is hexagonal in shape and has perforated partitions to permit segregation of four different varieties of parts to be treated at once. By removing these partitions, a single large area is usable to accommodate parts up to 4 feet in length.

tooling with plastics

By R. L. Dudley*

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MANY MANUFACTURERS are increasing production with plastic tools. By using tool plastics, the El Segundo Div. has reduced tooling costs, decreased shop fabrication time and improved tool efficiency.

The greatest savings have been accomplished through the use of laminated plastic tools, *Fig.* 1. Research has shown that a large number of inspection fixtures, trim and drill templates and router jigs, and some assembly tools can be fabricated from plastic laminates. Actual time figures indicate that large nesting fixtures are fabricated in 50 percent of the man-hours required for a similar metal tool. A minimum of 30-percent cost saving is obtained on all plastic laminated tools at El Segundo.

Laminated tooling has been developed for fabricating vacuum forming tools to make clear acrylic enclosure panels. Air-dry glass laminates used for the edge locking rings on acrylic forming tools greatly increase their efficiency and reduce costs. Due to the excellent thermal insulation properties of these materials, the acrylic sheets cool slowly and uniformly around the periphery, thus reducing the stress marks often found in acrylic plastic panels. Many of the tools being fabricated by the plastic tooling shop require hardened chrome edge trim bars to accommodate a finish filing operation. These bars, *Fig.* 2, are applied by a technique similar to that used on metal templates. The attaching bar for the chrome strip is incorporated in the original plastic lay-up.

Some applications require steel reinforcement where additional rigidity is required. Rods may be preformed and laminated into position without materially increasing the cost of the tools. Shown in *Fig.* 3 is a typical cross section of a laminated tool using structural steel reinforcing rod. After testing various grades of steel, common concrete reinforcing steel was chosen because of its low cost and formability.

Combinations of metal and plastic are often used to form contour location boards or nesting harnesses on large trim and assembly tools, *Fig.* 1. These are fabricated in the following manner: Dural plates are rough-sawed to allow approximately 3/8-inch clearance from the plaster shell that is to be used as a matrix. The matrix is prepared for lamination by applying a mold release agent. Layers of cloth and air-drying resin, used to fill the 3/8-inch space, are laminated in position and attached to the rough-cut contour plates by

Fig. 1. Trim fixture with laminated router template and phenolic base.



*Senior member ASTE Los Angeles chapter.

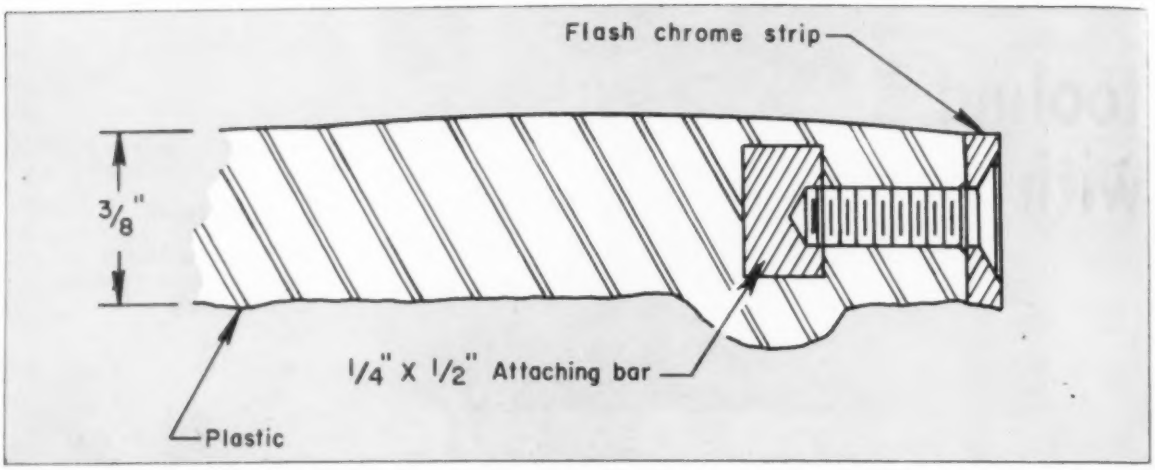


Fig. 2. Attaching bar used to receive screws for chrome strip is imbedded in plastic.

additional strips of cloth and catalyzed resin. The tool is allowed to set two to three hours until the plastic surface is tack free.

Jigs and fixtures for trimming and drilling heavy gage materials are fabricated by using combination solid-cast phenolic nesting bases, and laminated trim and drill templates, *Fig.* 4. Tools of this type are fabricated as follows: Plaster patterns and a solid phenolic casting is poured to form a nesting base. Master sheet wax is applied to the phenolic base to stimulate the required material thickness. The air-dried laminated template is then built up on top of the wax, assuring complete contour co-ordination. Special laminated type bushings can be embodied in the drill templates during the lay-up or added after the laminate is complete. The latter is done by spotfacing larger holes in the laminate and bonding the bushing in place by using catalyzed resin and short glass fibers.

Plastic drop hammer dies and double-action draw dies are made of phenolic casting materials and are often encased in steel boxes to withstand forming pressures. Thermoplastic materials are melted and cast for drop hammer dies and punches. Stretch-press dies and hydropress form blocks are cast from regular casting phenolics and various fillers, and need not be encased in steel.

Cellulose materials have been used for many years in fabricating aircraft drop hammer punches. Casting is comparatively easy if the proper heating facilities are available. Cellulose materials are usually heated in a double-boiler type mixing pot and poured at approximately 320 F into a warm die cavity. Cellulose materials require extensive feeding during their cooling cycle to compensate for the large amount of shrinkage on their open side. It is usually necessary to flame-heat the die mass during feeding to insure proper bond of the added material. Thermoplastic materials are reclaimable and have a long tool life.

The job outline that follows briefly describes techniques currently used at El Segundo for producing air-dry laminates:

1. Plaster shell is lifted from master plaster pattern or other master tool.
2. Flange areas are built up as required. A mold release compound of melted paraffin is brushed on and flanges are smoothed with a hand scraper and covered

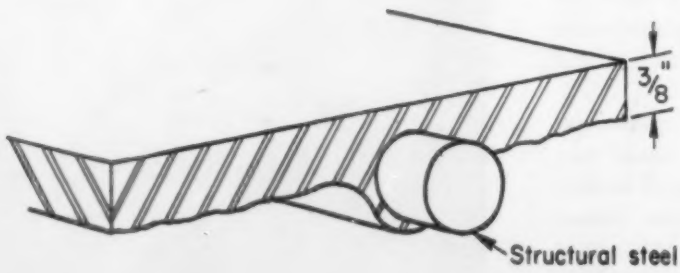


Fig. 3. Standard reinforcing method for nesting fixtures.

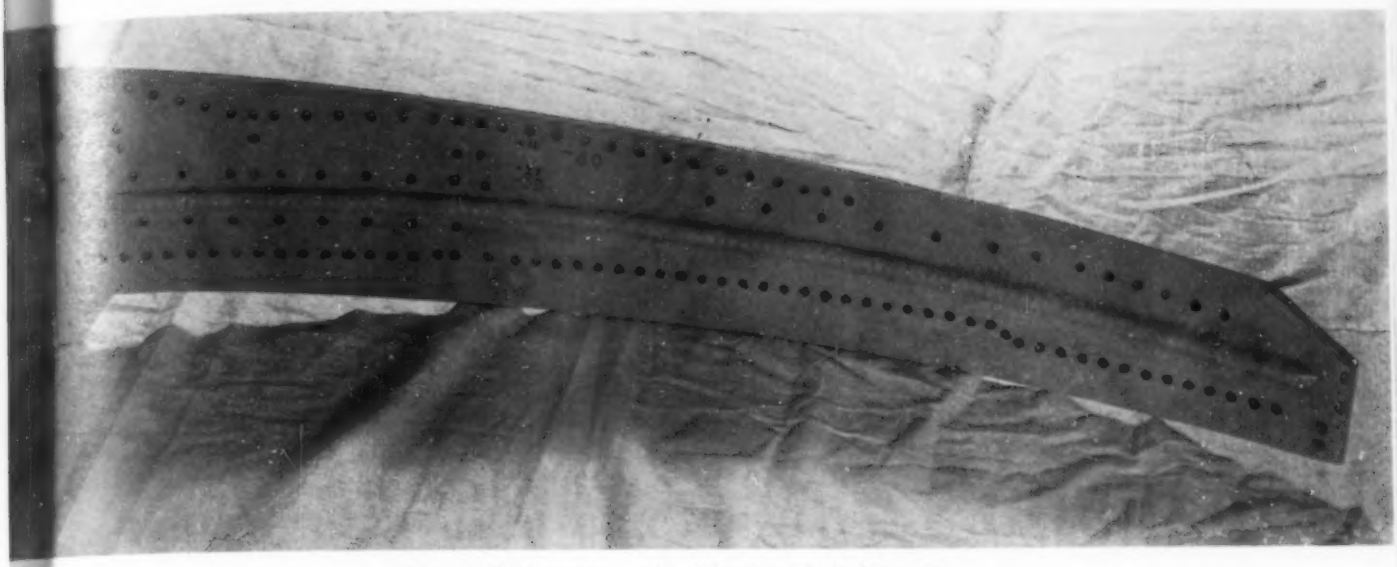


Fig. 4. Tool master made of laminated air-dry resin.

with a thin coat of vaseline.

3. As an alternate to the plaster pattern preparation, entire surface of plaster pattern is coated with carnuba wax, and 3 or 4 coats of sealing lacquer and 3 or 4 coats of plastic parting material are sprayed on. A thin film of vegetable-lecithin is wiped over entire surface. In some cases it is necessary to coat the complete plaster pattern with sheet wax to allow for material thickness. Such jobs require only a thin film of vaseline for release.
4. Laminates are prepared after thoroughly mixing the resin, which consists of: 95 percent resin, 3 percent resin extender and 2 percent setting fluid by weight. Extender and setting fluid should not be mixed together except in the resin.
5. Lay-up is performed by brushing a thin face coat of resin, which is allowed to gel; first layer of cloth is applied and impregnated with resin. This is repeated until required thickness is obtained.
6. Laminated tool is cured by allowing to air-dry at least 2 hours.
7. Laminate is removed and trimmed with a saw.

Phenolic castings are produced in the following manner at El Segundo:

1. Plaster is dried 8 to 12 hours at 125 to 150 F. Surface defects are removed by sanding. A thin coat of wax is applied and 3 or 4 heavy coats of sealer are sprayed on. After applying a second coat of wax, the finish is sprayed on in 3 or 4 coats. Carnuba wax is wiped on and polished.
2. Preparatory to pouring phenolic, the proper amounts of resin, catalyst and filler are weighed, mixed and poured. Phenolic is cooled at room temperature until exothermic heat has passed.
3. Casting is oven cured. Cure cycle varies with different resins and catalysts.

Although present application of plastic tooling is limited, advancements are continually being made. When properly used in conjunction with conventional tool materials, tool plastics can result in time and money savings.

'Milling' with Chemicals

PRECISION FORMING of metal parts from aluminum sheets or forging stock is possible for the first time without the use of any physical force through an economical process called Chem-Mill, originated by North American Aviation and developed in conjunction with Turco Products, Inc.

By this method, it is possible to avoid orthodox milling operations and still obtain pieces smooth enough that further finishing is unnecessary.

Parts to be "milled" are masked to cover all areas which are to remain unaffected during the work; the part is then immersed in a chemical bath and remains for an electronically time-controlled period. During immersion, unmasked portions are taken down easily and uniformly to any desired thinness. The electronic control insures accuracy for sculpturing complex, fragile and intricate parts to a fineness of 0.002 in.

Besides producing precision contouring of forgings or intricately shaped aluminum sheets, the process also offers the advantage of eliminating the danger of warpage, particularly in the cases of work on large curved pieces such as the skins for aircraft and guided missile parts. Close tolerances on almost any complexity of design may be held, while tapering, curving or other intricate work, often impractical with conventional equipment, is possible.

While currently confined to aluminum alloys, the methods application to other metals is under development.



(Left) Two 7¾-inch leveling screws produced of SAE B1112 screw stock by carbide tooled automatics; (center) inner race bearing of SAE 52100 steel tubing produced by machine shown in photo below; (right) shutoff valve center produced by means of carbide turning tools including carbide breakdown, forming, form taper, finish groove, shave and cutoff tools.

CARBIDES give automatics greater punch

TOOL AND MACHINE DESIGN engineers from two firms have linked forces in a joint development program aimed at discovering suitable application of carbide tooling on multi-spindle automatics.

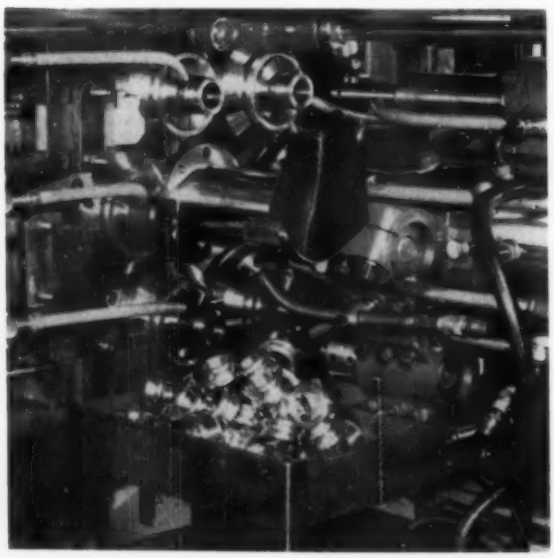
Cone Automatic Machine Co., of Windsor, Vt., had been interested for some time in developing the potential of carbide tooling, believing that their machines basically met all requirements.

For the past four months the company's engineers have teamed with those of Carboloy Department of GE to explore possibilities of carbides on actual jobs. Those chosen were selected to be representative of volume production by multi-spindle automatics, employing commonly known tools. For example, one machine was set up to handle the type of threading that can be accomplished with carbide tipped die head chasers. Another was set up to handle 52100 tubing in the production of ball bearing inner races. A third machine was tooled to make use of end and side tools that are familiar to all users of automatics. The three parts produced are illustrated above.

Typical of results, inner bearing races are produced on a 2⅝-inch, 6-spindle automatic at the rate of one every 10 seconds, or six per minute. This practically doubles the production attained with high-speed steel tools. The part is made from SAE 52100 steel tubing with only seven carbide cutting tools, half the number of high-speed tools commonly used.

In all three jobs coolants played an important part. The engineering group found by sealing off bearing and spindles of the automatics, water soluble coolants did an effective job when machine speeds were increased as much as 10 times. Parts come off the machines with no noticeable rise in temperature. Cooling efficiency was such that machine design engineers were able to decrease bearing clearances and adjust slides and carriers to closer tolerances. The end-effect is reflected in results.

Engineers of both companies feel that further development work is needed for widespread application of carbides to automatics and that only a beginning has been made. The trend to automation and fully automatic equipment, to secure more production per square foot of floor space, provides a rare opportunity for this type of development, they believe. Most important for successful commercial use of their findings is the need for the education of service and operating personnel.



Setup for producing inner bearing race on six spindle automatic utilizes all carbide tooling. Work is run at 519 rpm or 333 sfpm. Seven operations are involved.

electric controls

Part 2—Power Supply

By John C. Ponstingl

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ELECTRICAL CHARACTERISTICS of the power supply are important factors when selecting motor control components. A study of these characteristics such as voltage, frequency, number of phases, short-circuit current capacity and power source limitations will aid materially in understanding the various types of motor controllers. They are designed to accommodate different types of power supplies as well as different types of motors.

Voltage, Frequency and Phase: Power supply voltage may range from 110 to 33,000 volts. For single-phase power, it is usually 110 or 220 volts and generally is limited to lamps, heaters and fractional-horsepower motors. Single-phase motors as large as 10 hp are available, however.

Most industrial plants use polyphase power, 3-phase systems being most usual. If the approximate power demand is under 500 kva then the input voltage is usually 220 or 440 volts. If the power demand is 500 to 1000 kva, a 2300 or 4160-volt supply is usual. Above 1000 kva, the supply voltage may go as high as 33,000 volts. With the higher voltage, a distribution or power transformer, such as shown in *Fig.* 1, is located on the plant property (either outdoors or indoors) to reduce the voltage to a safe plant-distribution level.

Sometimes industrial plants find it desirable to generate their own power when the plant is not convenient to power supply lines or when waste steam is available to drive turbine generating equipment. Also, mobile equipment may require its own power generating system.

Since a motor can be reversed by interchanging two leads on a 3-phase system, phase-reversal protection is necessary on critical applications such as

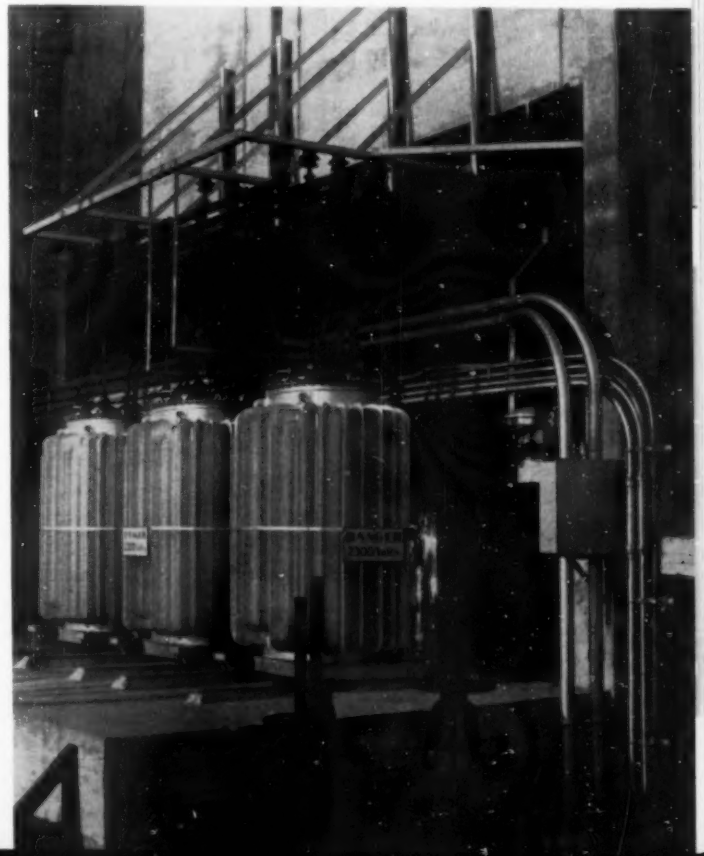


Fig. 1. Distribution transformers installed at a plant to reduce 2300 volts to 400 volts. This 3-phase bank is capable of producing over 50,000 amp short-circuit current, necessitating adequate current limiting devices to protect motor controls in the plant.

Table 1—Short-Circuit Current Developed by Typical Distribution Transformers

Transformer		Approximate Short-Circuit Currents	
Impedance (kva)	Rating (%)	240 Volts (amp)	480 Volts (amp)
150	5	9,600	——
	7	6,800	——
	9	5,200	——
200	5	12,800	——
	7	9,000	——
	9	7,100	——
300	5	19,200	7,850
	7	13,700	5,600
	9	10,700	4,360
500	5	32,000	13,100
	7	22,000	9,350
	9	17,800	7,300
750	5	48,000	19,650
	7	34,200	14,050
	9	26,600	10,900
1000	5	——	26,200
	7	——	18,700
	9	——	14,550
1500	5	——	39,400
	7	——	28,100
	9	——	21,800

elevators. Where temporary or mobile power supply systems are involved, phase reversal or sometimes single-phase protection is included in the control to protect the motor against accidental phase reversal or loss of one phase.

The voltage used for a particular drive affects the control in several ways. First, it affects the design and rating of the coils and transformers used in the control. Second, it indirectly affects the current rating or size of the contacts or contactors. For example, a NEMA size 2 linestarter is used with a 25-hp motor on a 440-volt power supply. The size 2 contactor is rated at 50 amp and the motor full-load current is approximately 32 amp. If the power supply voltage is changed to 220 volts and the same 25-hp motor is reconnected to be used on this lower voltage, the size 2 linestarter can no longer be used. First, because the motor full-load current is now 64 amp, far greater than the size 2 contactor rating and, second, because the contactor coil (rated at 440 volts) would not operate on the 220-volt supply. A NEMA size 3 linestarter rated at 100 amp must be used on the 220-volt system.

Standard frequencies in the U. S. are 25 and 60 cycles per second. The former, however, is being gradually replaced by 60-cycle systems. Fifty-cycle current, on the other hand, is used extensively in many foreign countries. The frequency of the power supply affects the design of all magnetic coils and transformers used in motor controllers. If a control is designed for use on a 25-cycle system, all coils and transformers must be replaced when it is transferred to a 60-cycle system. Coils designed for 440 volts at 60 cycles are normally acceptable for 380 volts, 50 cycles or 220 volts, 25 cycles, provided the iron or magnetic circuits are designed for operation on the lower frequency.

Short-Circuit Current Capacity: Standard motor controllers are designed to interrupt no more than ten times maximum current rating. Short-circuit currents must be cut off by the conductor over-current and short-circuit protective unit commonly called the branch-circuit protective device. This device must be selected with an interruption capacity equal to or greater than the short-circuit capabilities of the power supply.

The nearest distribution transformer, whether it be in the plant or in the power system, determines the maximum short-circuit current that might be developed. This fault current is limited by the total impedance of the power transformer secondary and the impedance of the wires connecting the transformer to the short-circuit. Listed in TABLE 1 are the impedances for the various power transformers and the resulting short-circuit currents that can be obtained. No allowance has been made for the wiring from the secondary of the transformer to the short circuit. In most cases, this would add to the total impedance of the secondary circuit and actually

reduce the currents somewhat below those listed in TABLE 1.

The significance of this is to show that the size of power source, in most cases the distribution or power transformer, determines the amount of short-circuit current that can be drawn; the larger the transformer the more short-circuit current possible. This is the deciding factor in choosing the rating of the protective devices in the motor controller, be they fuses or circuit breakers. If a short circuit should occur, producing a current of 20,000 amp in a system having fuses capable of interrupting only 10,000 amp, the power could not be interrupted by the protective device and considerable damage would result.

Since the capacities of many power generating systems have grown rapidly in recent years, the source of supply is able to deliver short-circuit current in excess of the interrupting ratings of previously standard protective devices. In plants using distribution transformers as large as 750 kva, it is necessary to use devices with interrupting capacities of 25,000 amp to provide adequate protection.

Certain power fuses and large circuit breakers are rated at 25,000, 50,000 or 100,000 amp interrupting capacity. Unfortunately, a device capable of interrupting 50,000 amp would be useless ahead of a motor controller if the motor controller could not momentarily handle this current. This condition could exist if such a short occurred on the load side of a motor controller.

Rather than having devices capable of interrupting the maximum short-circuit current, other means can be employed to limit the current. First, the reactance design of the distribution transformer can be used to limit the current. TABLE 1 illustrates how the short-circuit currents are reduced as the impedance increases. Hence if a new and larger distribution transformer is contemplated for a plant where 15,000-amp interrupting capacity breakers are installed in abundance, the proper transformer impedance can make the difference between a safe and hazardous installation. According to TABLE 1, a 300 kva, 240-volt, 7-percent impedance transformer (13,700 amp short-circuit current) would be compatible with circuit breakers having 15,000-amp interrupting capacities whereas a 300-kva, 5-percent impedance transformer (19,200 amp short-circuit current) would be unsafe to use.

Current-limiting fuses or shielded current-limiting reactors can also be used. These devices act as additional impedance to limit the short-circuit current. Current-limiting fuses have certain features that must be carefully considered before they are applied. In cascaded circuits where fuses and breakers are used, selective fault clearing of fuses and breakers is extremely difficult because of the fixed current-time characteristics of the fuses. A fuse should not clear a fault that is within the circuit breaker rating; however, due to the tripping time of the breaker, a fuse usually blows before the breaker trips. When fuses are used, single phasing is possible. This is undesirable on motor-drive cir-

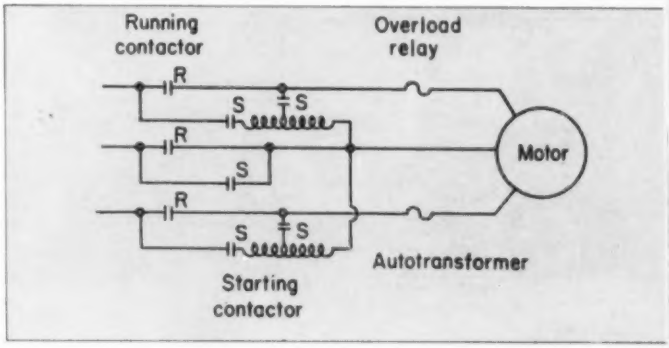
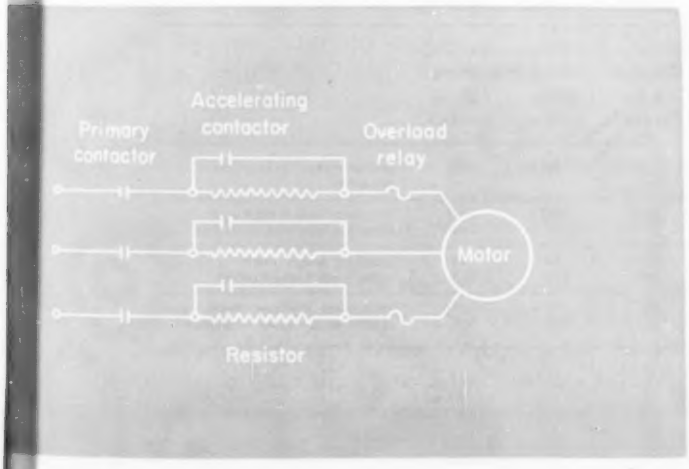
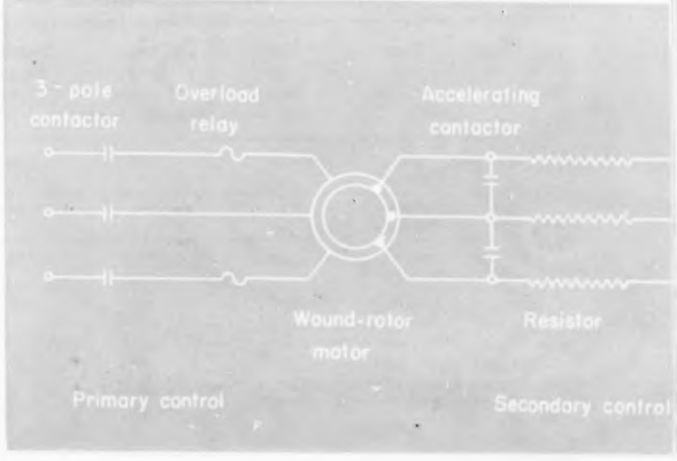


Fig. 2. (below) Power circuit for a 2-point resistance-type reduced-voltage starter.

Fig. 3. (right) Diagram for the power circuit of an autotransformer starter.

Fig. 4. (lower right) Power control circuit for a wound-rotor motor using 2-point secondary resistance type acceleration.



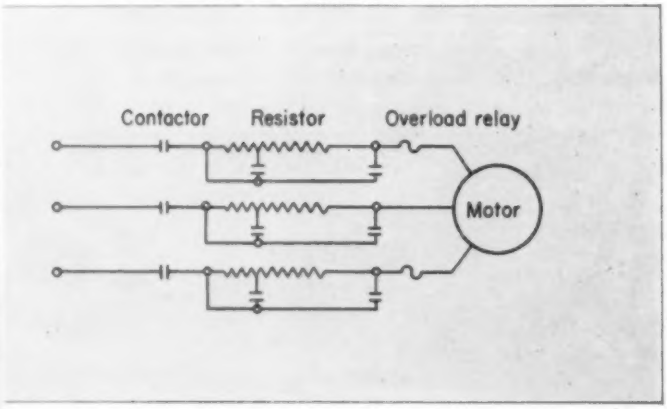


cuits. Under partial fault conditions, fuses can be damaged so that normal or momentary overload current may cause them to blow. From a maintenance point of view, the fact that fuses must be replaced after each operation may be an argument against their use.

Current-limiting reactors can be applied either in the main feeder bus or in the branch circuits. When used in the main feeder, they produce a voltage drop on all branches when a fault occurs on one branch. Therefore, they are best applied in the branch circuits to protect a group of small breakers. Each branch is then essentially independent of the others.

Power Source Limitations: On small power systems and also where no automatic voltage regulation is used, heavy inrush or starting currents of some motors may reduce the system voltage to the point where other equipment on the system may not function properly. Resistors placed in series with the line will limit the starting current of squirrel-cage motors. *Fig.* 2 shows a typical resistance type reduced-voltage starter. Unfortunately, the starting torque drops considerably. Autotransformers, while limiting the inrush current, actually permit more motor torque per amp of starting current. *Fig.* 3 shows a typical autotransformer starter. Sometimes the starting requirements of a squirrel-cage motor are greater than possible with either a resistance or autotransformer starter. Then it may be necessary to use a wound-rotor motor and its associated adjustable rotor-resistance control, *Fig.* 4, because this combination will give much more starting torque with less inrush current. Comparative features of various controls are tabulated in TABLE 2.

Fig. 5. Three-point acceleration for a resistance starter when starting currents must be regulated.



On power supplies that have automatic adjustment of voltage (such as network systems) there is a limit as to the increments of current that can be drawn at one time. As long as the current is increased in steps far enough apart to permit correction by the regulator on the power-generating equipment, larger total currents can be accommodated. If a regulated system can tolerate load applications of only 50 amp per second to permit the regulator to catch up with the "loading up" of the power supply, then a 150-amp motor load could be applied in three steps, in increments of 50 amp per second. On the first step of a 3-point resistance starter as shown in *Fig.* 5, sufficient resistance would limit the inrush current to 50 amp. After one second, enough resistance can be removed to increase the motor currnt to 100 amp. After another second, all the remaining resistance can be removed to bring the motor current to 150 amp. The power supply is now adjusted to this load demand, and the motor can proceed to accelerate.

An objective study of the power supply always pays dividends in a control application. A later article on a-c motor controllers will show how the similarities of various motors aids in understanding and cataloging a-c motor control.

Table 2—Typical Controls Used to Limit Motor Starting Currents

Type of Motor	Type of Starter	Volts at Motor (% of line)	Typical Inrush Current (% full load)	Starting Torque (% full load)	Cost (Magnetic Starter Plus Motor) 5 hp (index)	20 hp (index)	150 hp (index)	Features
Squirrel cage	Line-starter	100	600	150	54	64	74	Inexpensive—high inrush currents
Squirrel cage	Primary Resistance	65	390	63	100	100	100 106†	Starting losses high—closed transition starting
Squirrel cage	Auto-transformer	80	390	96	111* 145	89* 111	76* 100	Starting losses low—open transition starting
Wound rotor	Secondary Resistance	100	150	150	200* 220	177* 210	120* 137	Maximum starting torque per input amp—most expensive

*Manual type starter.

†3-point type starter to compare with standard 2-point resistance type magnetic starter.

electroforming

a method for producing intricate shapes

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ELECTROFORMING is a means of producing an article by electrodeposition. The shape of the part is determined by that of the removable mold or matrix on which the metal is deposited. While the process is over 100 years old, the term "electroforming" was coined much more recently by Dr. William Blum, former chief of the Electrodeposition Section of the National Bureau of Standards. In the past 10 to 15 years applications of this process have increased rapidly.

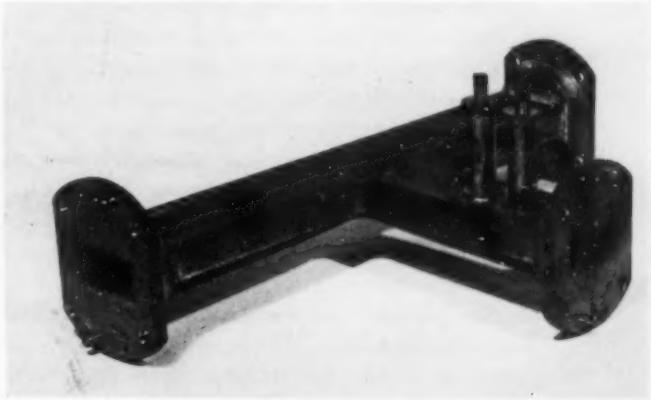
Parts that have been successfully made by this process can be classified in four groups: (1) flat types, such as screen, paint spray stencils and masks, and electrotype; (2) cavity types, such as radome molds, reflectors, tire molds, musical instrument bells, pen caps and plastic molds; (3) tubular types, such as precision bellows, venturi nozzles, wave-guides and fittings; (4) "grown-in" types, such as pitot tubes, heat exchangers, precision sliprings and commutators. A typical application of electroforming is shown in *Fig.* 1 and an unusual application in *Fig.* 2.

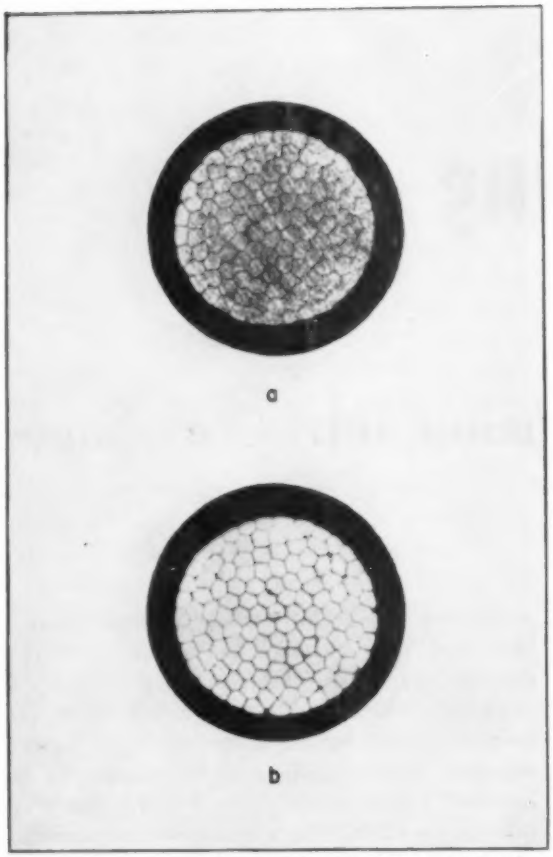
Parts made by this method range in size from tubes with a bore diameter of 0.002 inch to large molds for plastic aircraft fuselage parts. Deposit thickness may range from a fraction of a mil to 0.5 inch or more. Surface details as fine as one-millionth of an inch are accurately reproduced. This characteristic is of especial value in the manufacture of parts such as wave-guides and plastic molds. The desired finish and dimensions are automatically reproduced on the inside of the electroformed part from the outside surface of the matrix. To produce the same finish and dimensional accuracy on the inside of a part by machining would be extremely difficult. Electroforming is therefore a logical method of fabrication for the following situations:

1. Simple, symmetrical, thin-walled parts.
2. Complicated parts capable of reproduction by electroforming where machining is difficult and costly.
3. Parts in which components can be readily grown-in but which could not be assembled by standard methods.
4. Parts with critical inside dimensions and finish.
5. Small numbers of parts where standard methods of fabrication involve high tooling costs.

In some of these instances electroforming may be the only way by which a part can be made. If the part is well adapted to electroforming, cost of production by this method may be less than by standard methods. On the other hand, if standard methods of

Fig. 1. Electroformed wave-guide with fillets in corners.





—*Photo courtesy Varian Associates, Inc.*

Fig. 2. Electroformed copper grids made by special process: *a*—grid with aluminum core; *b*—grid with core dissolved. Web is approximately 0.0002 inch thick. Magnification is 4X.

fabrication, such as machining, casting or stamping are readily applicable, electroforming may not be indicated.

Matrix Design and Use

The mold or matrix, which is the base for the electroformed part is usually a negative of the desired product. An under-dimensioned positive mold can also be used, but the outside surface of the product will not be an accurate reproduction unless it is a thin-walled part.

Matrices are made by standard methods of fabrication, such as casting or machining. Electroforming is also a good method for making matrices. Highly accurate negative matrices may be electroformed on a single machined positive.

Matrices are either permanent, soluble or fusible. A permanent, or re-usable matrix, is employed when its shape is such that it can be removed without damage to itself or to the electroformed part. This type of matrix is usually of metal, although wood, glass or plastic can be used. A wide choice of metals is available. Each material has certain advantages and limitations.

A soluble matrix is useful when a higher finish and smaller tolerance are desired than can be obtained with a fusible matrix, but where a permanent matrix cannot be withdrawn; in cases where creep would distort fusible metal or wax matrices; and in cases where a thin-walled electroformed part has insufficient strength to permit withdrawal of the matrix. Fusible matrices are used where the shape will not permit withdrawal of the matrix, but where the accuracy of a soluble matrix is unnecessary. Matrix materials are listed in TABLE 1.

Two subjects concerning matrices that are of much importance to the electroformer are (1) methods for separating the electroformed part from the matrix and (2) methods for applying conducting films to nonmetallic matrices.

Separating Methods: A film must be formed on permanent metal matrices to prevent adhesion of the electrodeposit. At the same time the film must be thin enough that the surface remains conductive and permits formation of a sound, accurate replica. If the bond between the matrix and the deposit is too weak, premature separation or blistering may occur, especially with stressed deposits such as nickel. If the bond is too strong, separation may be impossible.

Plain steel may be treated with graphite, either wet or dry, rubbed on vigorously with a brush. The excess is flushed off with water spray. An oxide or chromate film can be formed on steel by treating the clean metal surface with a dilute chromate solution, such as 0.1 percent potassium dichromate. Alloys such as stainless steel, Inconel or Invar, have natural oxide films on their surfaces which prevent adhesion. Nonhomogeneity of these alloys, however, may result in adhesion of the deposit on small areas unless a special passivation treatment is applied. The following cycle is effective on stainless steels: degrease; alkali clean; rinse; make cathodic in a 20-percent sulphuric acid solution of 6 volts for 1 to 3 minutes; rinse, dip in a 5-percent hydrochloric acid solution for 5 to 10 seconds; rinse; dip in a dilute dichromate solution and rinse.

Deposits on a chromium plated matrix blister easily. A satisfactory treatment for preventing this consists of the following steps:

1. Clean mechanically with a fine abrasive.
2. Etch cathodically at 6 volts in a 10 to 20 percent sulphuric acid solution.
3. Rinse and clean in an alkaline electrolytic cleaner.
4. Rinse.
5. Repeat steps 1, 3 and 4.
6. Place in plating bath.

A silver flash is sometimes plated on a matrix and subsequently treated to form a separation film of either silver sulfide or silver iodide. Immersion of the silver in a solution of 1 to 2 oz per gallon

of sodium sulfide for 5 to 10 minutes will produce a satisfactory sulfide film. The same procedure may be used to produce sulfide separation films on low-melting alloys, and on copper, brass, nickel and iron.

A silver iodide film on silver is produced by immersing the matrix in a dilute solution of iodine. The latter can be prepared by dissolving 1 fluid ounce per gallon of pharmaceutical tincture of iodine in water, or by dissolving 1 oz. of iodine and potassium iodide in one gallon of water.

Another type of separating film is of fusible metal. The matrix is plated with 0.001-0.002 inch of a low-melting metal such as lead, tin or cadmium. By placing the electroformed part, containing the matrix, in a furnace or oil bath, the film melts and the matrix can be readily withdrawn. This technique is useful for long, untapered sections. The thickness of the fusible film must be allowed for when machining the matrix if dimensional tolerances are small.

Techniques for removing permanent matrices from the electroform depend on the size and shape of the article. In general a jig is required, which applies a removing force by means of a screw or press.

Removal of Invar matrices is facilitated by heating. Thermal coefficients of expansion of the other common materials are so close that thorough heating yields no advantage. Quick heating to expand the electroform before the mandrel temperature rises appreciably is sometimes helpful. Rolling or burnishing to slightly expand the electroform may prove a useful technique to aid in removal.

Since deposit adhesion is no problem with non-conductive matrices such as glass or plastics, no separation film is needed. Fusible matrices of the low-melting alloy type require treatment to form a separation film. If no film is present, globules of the alloy adhere to the surface of the electroform after the matrix has been removed by melting. A sulfide film may be produced as previously de-

Table 1—Comparison of Matrix Materials

Type	Material	Advantages	Disadvantages
Permanent	Plain Steel	Availability Low cost	Attacked by some plating solutions, such as acid copper and hot iron chloride
	Plain steel plus chromium or silver plate	Improved hardness and/or corrosion resistance Coating can be stripped and renewed	Chromium coating may be pitted by hot chloride type baths
	Stainless steel, Inconel	Inert to most plating solutions Natural oxide film prevents adhesion of most deposits	High cost Soft surface of non-hardenable types is easily scratched
	Invar, Kovar	Low temperature coefficient of expansion facilitates removal from electroform Non-adherent	High cost Poor machinability
	Brass plus plated coating (nickel, chromium, silver)	Good machinability Low cost	Surface easily scratched when plated with silver and nickel
	Glass, quartz	Close tolerances High finish	High cost Fragility Requires a conductive coating
	Wood, plaster, plastic, etc.	Low cost Moldability Flexible types can be withdrawn from undercuts	Large tolerances Requires a conductive coating and/or sealing
Soluble	Aluminum	Good machinability Good finish Close tolerances can be held in complex, non-withdrawable shapes Readily soluble in sodium hydroxide	High cost Surface easily scratched
	Zinc and zinc alloys	Can be die cast	Acid stripping solution more likely to attack electroform than caustic solution used for dissolving aluminum mandrels
	Plastics	Moldable Low cost Fairly close tolerances	Cannot be used in hot plating baths May swell in some baths Require a conductive coating
Fusible	Low-melting alloys (lead-tin-bismuth types)	Can be cast at low cost	Difficult to remove completely from electroform
	Waxes	Can be cast or molded at low cost	Easily scratched May deform by creep Require a conductive coating

scribed, or for alloys containing lead, an oxide-sulfate film can be formed. The latter type of film is produced by making the matrix anodic in a 20-percent solution of sulphuric acid for 2 to 3 minutes, after standard degreasing and cleaning procedures. Hot cleaning solutions cannot be safely used for the low-melting alloys.

Aluminum matrices must usually be treated to obtain an adherent deposit without blistering. The common zincate process is suitable. If a high surface finish is required, care must be taken to avoid over-etching the aluminum during the cleaning cycle. Copper from a pyrophosphate bath may be deposited directly on clean aluminum mandrels.

Conducting Films: Standard methods are used for metallizing nonconducting matrices. Porous matrices such as plaster or wood must be sealed with wax or lacquer prior to metallizing. A film of silver or copper may be applied by chemical reduction. Chemically reduced silver is most economically applied with a spray gun. Bronze or silver lacquer can be applied by brushing or spraying where dimensional tolerances are adequate. Graphite is used on wax molds. Other more specialized methods are evaporation, cathodic sputtering and firing-on of silver-containing frits on glass or ceramic molds.

Since the conductivity of all of these films is low, electrical contacts must have adequate area. If the object is large, several contacts may be necessary.

Table 2—Deposit Distribution on Angles

	Angle (degrees)	Fillet Radius (inch)	Deposit Thickness at apex (inch)	Deposit Thickness ¼ inch from apex (inch)
Inside Angles	45	0.008 0.064	zero 0.0010	0.0010 0.0018
	90	0.008 0.064	zero 0.0015	0.0013 0.0020
	135	0.008 0.064	0.0015 0.0016	0.0020 0.0027
Outside Angles	45	0.030 0.086	0.0110 0.0120	0.0060 0.0070
	90	0.030 0.086	0.0070 0.0100	0.0040 0.0050
	135	0.030 0.086	0.0060 0.0065	0.0040 0.0047

Note: All angle specimens have shank lengths of ½ inch. Solution: Acid copper sulfate. Current Density: 10-40 amp per sq ft.

Data from Kronsbein & Morton, Proc. Amer. Electroplaters Soc., 1949, p. 229.

Part Design Factors

Electroformed articles can be produced at lower cost and with improved quality if the design takes in account the limited "throwing power" of plating baths. Deposits on projections are thicker than average while those in recesses are thinner. This is shown by the data given in TABLE 2. The electroformer can partially compensate for these irregularities by using "current thieves" and "shields" to control the pattern of current distribution. However, these expedients add to the cost of a part.

Use of the following design rules will simplify electroforming problems, result in sound deposits:

1. Recesses should be as wide and shallow as possible.
2. Sharp internal angles should be avoided. Internal

Fig. 3. (lower left) Cross-section of copper deposit from acid sulfate bath in a sharp right angle shows weak plane formed by juncture of columnar crystals growing from sides of the angle. Magnification is 50X.

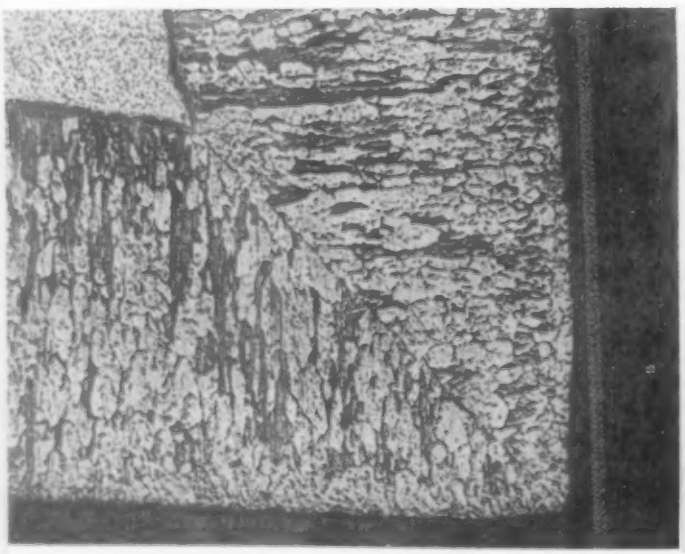
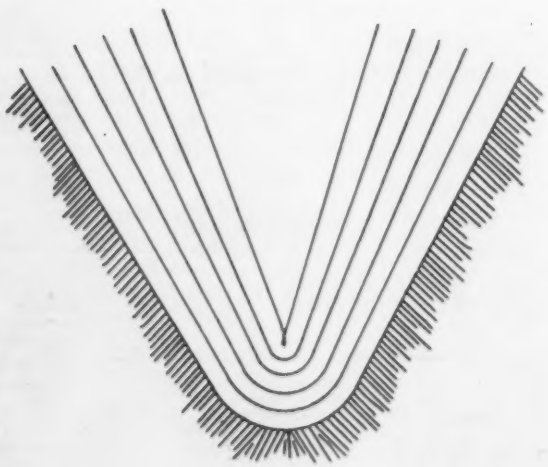


Fig. 4. (lower right) Sketch of a cross-section of an electrodeposit in a filleted internal acute angle. The long lines indicate build-up, showing the creation of a cleavage plane when the deposit thickness exceeds the radius of the fillet in the base.



angles should preferably be obtuse, with fillets at their apexes.

3. Projections should have rounded contours and outside angles should have radii at their apexes.

Functional requirements may demand compromises with these rules, but the compromise design is still likely to be better than one arrived at without consideration of the rules.

Theoretically it is impossible to deposit metal in the apex of any sharp angle and this is confirmed in TABLE 2. Further research has shown that for nickel and copper deposits, if the radius of a fillet in a 90-degree angle exceeds 0.02 inch per 2 inches of shank length, the ratio of the thickness of deposit in the corner of the angle to the thickness on the shank becomes nearly independent of the radius. The relative thickness in the corner drops off rapidly with decrease in radius. This is therefore the minimum radius that should be used.

Sharp internal angles, however, do fill in with electrodeposits of sufficient thickness. The manner in which this occurs is shown in *Fig.* 3. Columnar crystals grow out from the sides of the angle to meet in a cleavage plane bisecting the angle. The strength of the metal in such a cleavage plane is very low. This condition can best be avoided by use of a fillet at the apex of the angles. Experience indicates that the following approximate rule applies: A fillet whose radius is equal to or greater than the thickness of the electrodeposited metal will prevent the formation of a cleavage plane in the apex of an internal angle. *Fig.* 4 illustrates the geometric basis for this rule. It shows also that if the deposit is thicker than the radius of the fillet, a cleavage plane will form in the portion of the deposit in excess of this thickness. Such a combination deposit in an angle will naturally be stronger than one without such a deposit in the angle. An actual electrodeposit with a combination structure is shown in *Fig.* 5.

Two hypothetical matrices illustrating the above discussion of angles are shown in *Fig.* 6. A deposit on *a* would be weak all around *ABCD*. Therefore a fillet is desirable if significant joint strength is needed. A deposit on *b* would be weak along *A' B' C'*. This weakness, however, is compensated by high strength along *A' C'*. If a part with a design like *a* requires both strength and a sharp corner, a substantial thickness of metal can be first deposited in the corner, following which a fillet can be formed with solder, sprayed metal, low-melting alloy or plastic. A sound deposit can then be built up over this fillet. The cross-section of such a corner is shown in *Fig.* 7. This figure also shows incorporation of an insert in a wave-guide mandrel.

Growth of a cleavage plane may be stopped by an intermediate machining operation, which has been performed on the part shown in *Fig.* 8.

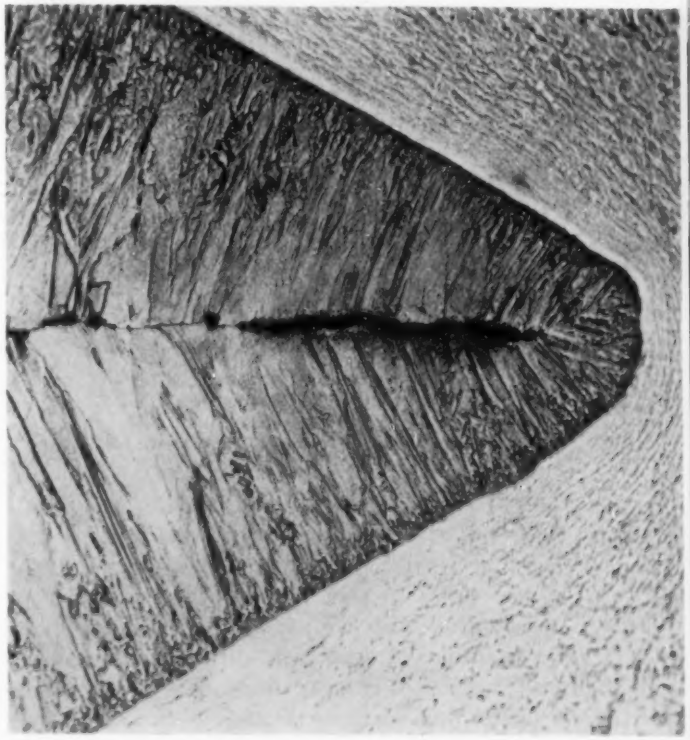
Sharp outside angles present a less difficult problem to the electroformer than sharp inside angles, and can be employed if needed. If sharp angles are nonessential, replacement by rounded-off contours may result in lower costs in the electroforming operation through elimination of thieving, intermediate machining or other steps.

In addition to the above rules on angles and recesses, the following points should be considered by the designer. Certain combinations of metals used in assembly of a matrix may present difficulties. For example, plain steel inserts or joining pins, which are susceptible to attack by an acid copper solution, are often placed in a matrix made mainly of an inert material such as stainless steel. Copper or brass inserts in an aluminum matrix also cause difficulty in preplating processing. When combinations are contemplated, the designer should consult with the electroformer regarding their suitability.

The design should include some sort of handle on the matrix. For example, a wave-guide matrix requires extra unplated length to provide a reference point for machining the outside surface. A handle may also serve as a means for suspending the matrix in the plating bath and as a means for making electrical contact.

In designing permanent matrices, provisions should be made for applying a separating force, for example, by means of a screw or an arbor press. With soluble matrices, provision for circulating the

Fig. 5. Actual cross-section of a deposit from an acid sulfate bath in a filleted internal acute angle, showing sound deposit in fillet and cleavage plane. Radius is 0.0025 inch; magnification is 200X.



dissolving agent through the matrix will greatly increase the speed of dissolving. Thus, an aluminum matrix for a wave-guide should be drilled with a hole extending its full length.

As an approximate guide, it may be stated that average deposit thickness can be controlled to ± 10 percent. If the shape is simple, thickness variation from point to point may also be held within ± 10 percent, but if it is complex, the thickness may vary several fold between different areas.

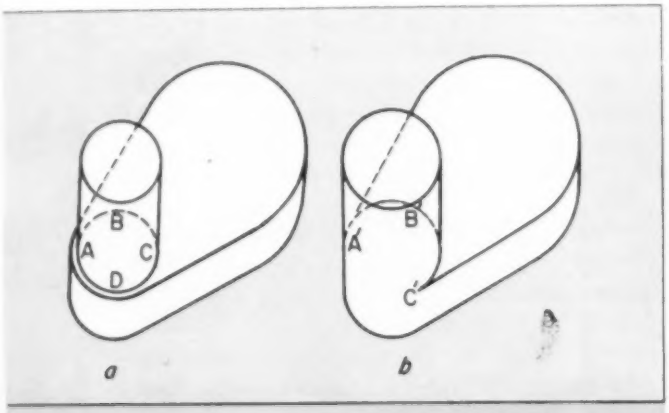
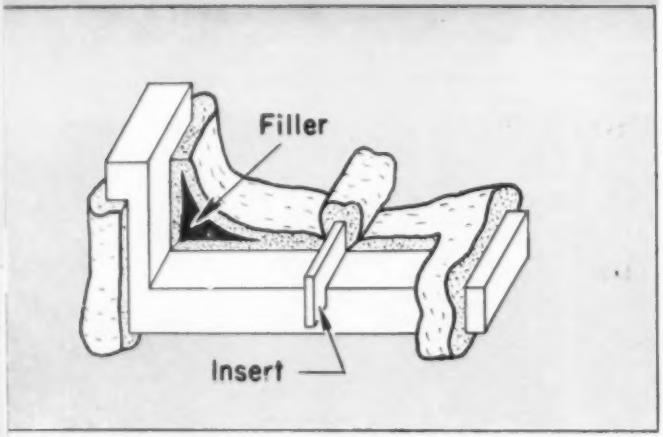


Fig. 6. Comparison of matrix joints. Design *a* is weak; design *b* improved.

Fig. 7. Matrix showing build-up of deposit in a right-angle corner with a fillet fill-in and deposit on a built-in insert.



Metals Used for Electroforming

Only four metals are commonly used for electroforming: copper, silver, nickel and iron. Some of the physical properties of these metals, as electrodeposited and after annealing or heat-treating, are shown in TABLE 3. One of the advantages of electroformed metals is that physical properties can be varied over a fairly wide range by simply changing the conditions of deposition, such as solution composition, current density, temperature and addition agents. Physical properties can be further controlled by annealing or, in the case of iron, by case-hardening. The latter treatment, however, may lead to dimensional distortion.

Other pure metals which could be used if their properties are needed include gold, zinc, lead, antimony and chromium. Some of these have distinct limitations. For example, it is difficult to plate thicknesses of more than a few thousandths of an inch of gold. Gold is most likely to be useful as a lining or coating for an article made mostly of another metal. Antimony and chromium suffer from extreme brittleness.

While many alloys can be electrodeposited, none have acquired an important place in electroforming. Several recently developed alloy deposits, including cobalt-phosphorous, nickel-phosphorous and cobalt-tungsten, have high hardness and strength and are further hardenable by heat-treatment — properties which may make them useful in certain applications such as metal forming dies. Their properties are also shown in TABLE 3.

Laminated metals are commonly used in electroforming and have definite advantages for certain applications. Thus, in wave-guides, silver or copper can be used on the inner surface for electrical conductivity, backed by nickel or iron for strength. Parts which require corrosion resistance can be formed with nickel on the inside and outside surfaces with iron sandwiched between to reduce cost and to conserve nickel. Many such opportunities for advantageous use of laminates will occur to the designer who is aware of this possibility.

One other metal that should be mentioned is aluminum. While it cannot be deposited from aqueous solution, nonaqueous solutions have recently been developed at Battelle Memorial Institute and at the National Bureau of Standards from which thick, sound deposits can be made. Difficulties remain which render electroforming with aluminum impractical for large production at the present time, but limited applications can be made if the need justifies the cost. Future improvements in plating of aluminum can be expected.

Plating Solutions

Details of composition and operating conditions for all of the common plating baths are readily available in the technical literature. This discussion is therefore limited to an indication of the types of solutions best adapted to electroforming.

Copper: A variety of baths are suitable for electroforming with copper, including the acid sulfate, fluoborate, pyrophosphate and the high-speed cyanide type with periodic reverse current. The acid sulfate bath remains a favorite because of ease of control and the fact it is practically foolproof. An addition agent, such as phenolsulfonic acid, or any

one of several proprietary addition agents, is helpful in producing smooth, fine-grained deposits.

The high-speed potassium cyanide used with periodic reverse current[1] has interesting properties for electroforming. Deposits can be made smooth and bright even at maximum thicknesses. By varying the reversing cycle, throwing power can be controlled to some extent. Thus, highly sacrificial cycles will prevent build-up of metal on corners. Disadvantages are that control of composition and agitation are critical. An acid copper strike is required on separable mandrels, because a direct reversing deposit usually blisters.

Silver: The high-concentration silver bath developed during World War II for silver plating of engine bearings is excellent for electroforming.[2] It can be used with or without a brightener. This type of bath is stable and easy to maintain, and produces smooth deposits of almost any desired thickness. Periodic reverse current can be used, but is unnecessary. With certain matrix designs it may have value as a throwing power control.

Silver is not too expensive for many applications. It is used as a high-conductivity lining for waveguides and related equipment, for electrical contacts, and for electroformed commutators and slip-rings for special instruments.

Iron: The hot ferrous chloride-calcium chloride type of bath has been commonly used. It is simple

[1]References are tabulated at end of article.

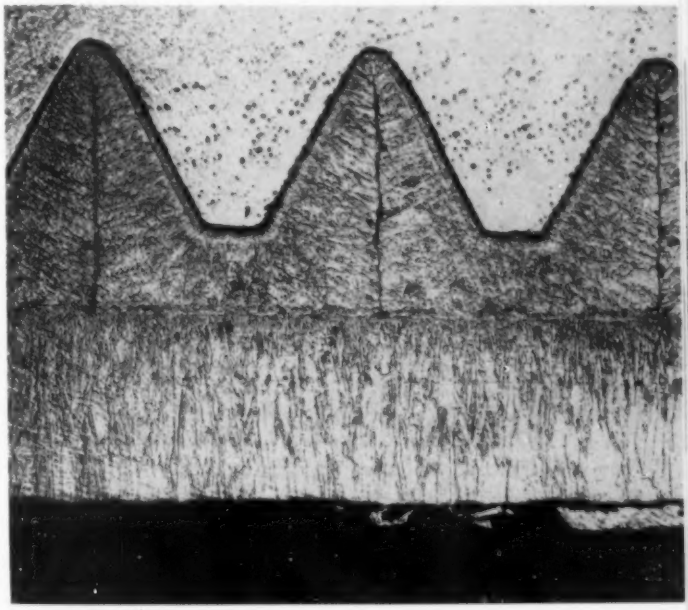


Fig. 8. (right) Cleavage planes in acute angles have been interrupted by machining. The layer deposited on machined surface is sound and strong.

Table 3—Typical Physical Properties of the Commonly Used Electroforming Metals

Metal	Plating Solution or Treatment	Tensile Strength (psi x 10^3)	Ductility Elongation in 2 inches (%)	Hardness (Vickers)
Copper	Acid sulfate	34-68	33-48	42-83
	High-speed cyanide with periodic reverse current	—	—	100-220
	Fluoborate	17-38	6.5-18.5	41-71
Silver	High concentration high-speed cyanide	34-48	12-19	55-93
Nickel	Watt's (soft)	60-80	10-30	140-250
	All chloride (medium hardness)	90-135	4-17	200-350
	Ammonium salt type (hard)	140-160	4-9	350-500
	Sulfamate	—	6-8	550-650
Iron	Ferrous ammonium sulfate	113	0-3	180-350
	Hot ferrous chloride	55-80	15-25	135-220
	Annealed at 900 C	35-47	25-40	50-90
Cobalt-tungsten alloy	As plated	120	0-slight	330-620
	Heat treated	—	Ductile if heated above 900 C	250-1000
Cobalt-phosphorous alloy	Low phosphorous (1 percent), as plated	130	0-7	350-700
	Heat treated	—	0	500-1100

to control, can be operated at high deposition rates, and gives strong, ductile deposits. Good results have also been reported with the ferrous fluoborate bath.

Nickel: The standard Watt's bath is probably used more commonly than any other for electroforming, although use of the sulfamate,[3] all-chloride and hard nickel baths has been reported. Stress in the deposits, leading to warping and cracking, is one of the main difficulties encountered. If the pH and composition of the bath are carefully controlled and it is continually electrolytically purified, stress is no serious problem. It has recently been reported that superposed alternating current reduces stress.

With a highly purified bath, plus adequate agitation, pitting is usually not encountered. Addition agents should be avoided, as either the addition agent or its decomposition products cause highly stressed deposits. Stress-reducing agents such as saccharin are only temporarily effective. A pH of about 4.5 gives good results.

The use of anode bags or cathode diaphragms, continuous filtration and vigorous agitation is essential in electroforming. The best type of agitation will depend on the type of bath and the shape of the part. Symmetrical cylindrical shapes may be rotated, although this type of agitation sometimes produces spiral striations in the deposit. Random agitation, as secured with plunging motion, or with air, is good for complex shapes. Air agitation can be used with all of the baths described except the iron baths.

There are doubtless many machine and equipment parts, which could be produced more cheaply or better by electroforming than by current methods. As engineers and designers become more familiar with the possibilities of electroforming, as advances are made in plating solutions and techniques, and as more platers gain experience in the special electroforming techniques, the use of this production method will increase progressively.

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   "Adherent and Dense Heavy Silver Deposits," Ralph A. Schaeffer, Ibid, 33, 1176, (1946).
3. **"Sulfamate Nickel Plating," C. F. Gurnham, *Products Finishing*, '53 (Oct. 1953).**

Quality and Economy from Special Extrusion Process

Since 1942, the Scaife Co. has made a 4.2-inch mortar shell as a three-piece assembly of seamless tubing and machined components. Engineers, searching for a new method to produce the shells, found their answer in a modification of the Ugine-Sejournet extrusion process using glass as a lubricant. This method makes it possible to produce the shell in one piece from a simple billet, yet offers the attendant advantages of reduced cost and materials savings. Substitution of the billet stock for seamless steel tubing offers a reduction of 25 percent in steel used, and at the same time offers a means of saving critical material in times of emergency.

Steps in the process proceed thus: The now one-piece mortar shell, with nose adapter integral to the body starts as a slug of SAE-AISI 1035 carbon steel bar. This is heated in a high-speed gas furnace to extrusion temperature. Glass, either in the form of powder or woven glass fiber, is then applied and the slug is positioned in the press. Actual extrusion is completed in less than one second with the glass acting as a viscous lubricant between the die, punch and workpiece.

The process is described as combining advantages of both conventional hot forging and cold extrusion. The former permits drastic reforming of material in a single press operation, but generally with poor dimensional control; the latter provides close dimensional control, but requires many press operations In the improved method, glass lubricant facilitates the hot press forming and allows new die designs providing greatly improved dimensional control.

Now improved surface conditions minimize subsequent machining: there is a high extrusion ratio between size of original slug and finished piece; and extrusion pressures are reduced.

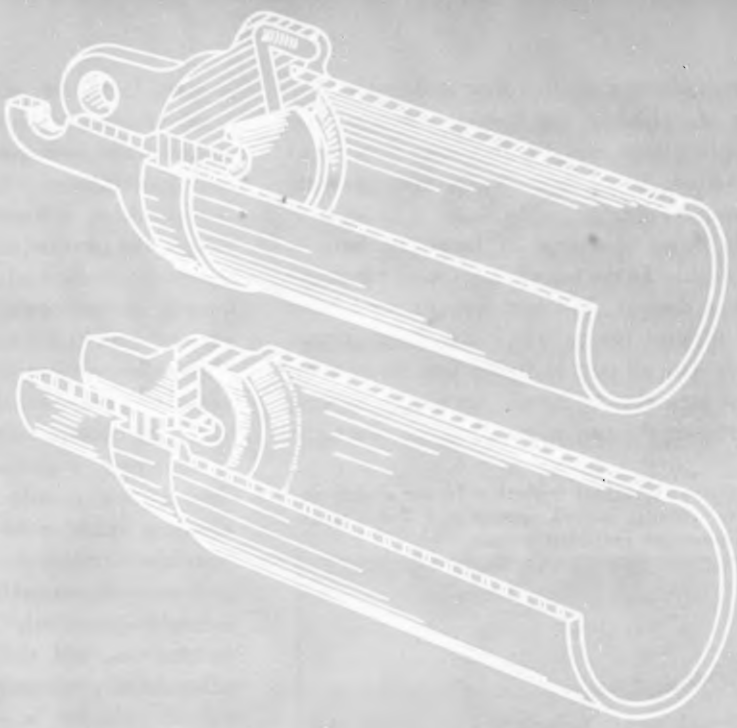


Fig. 1. (Above) Original cylinder design with head bolted to tubing; (below) one-piece extruded construction.

design of steel parts

for cold extrusion

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Mullins Manufacturing Corp.
Salem, Ohio

VERSATILITY OF FORMING STEEL by cold extrusion has opened new possibilities in basic design and in cutting manufacturing costs. One of its major contributions to cost reduction is that cold extrusion can eliminate many operations formerly required to produce a finished part. Even more important, however, is that recently developed cold extruded shapes permit new designs previously impossible or uneconomic by conventional methods.

Since the best method of cutting costs is through elimination of as many operations as possible, the economic advantage of cold extrusion in these cases is self-evident. The second factor of saving money by redesign is somewhat more complex and elusive.

Since 1950 Mullins has been experimentally producing Koldflo extruded objects other than artillery shells. In the interest of clarifying any misconception about the capabilities or limitations of cold extrusion, case histories of specific design problems will be discussed.

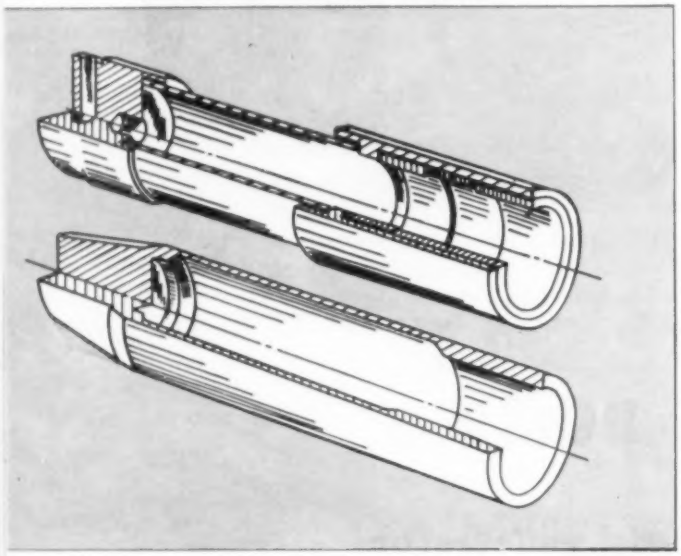
Because of the rapid and diversified expansion of the hydraulic or fluid power industry, much of the latest cold extrusion development has centered on the production of cylinders, accumulators and other containers for this industry. This does not mean that the process is restricted to this type of part. This is, however, the first large commercial application wherein mass produced cold extrusions are used, because: (1) large requirements of a single size or type of cylinder exist and the process is a mass production method; (2) conventional

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cylinder manufacture is often slow and costly; (3) high cost of cylinders was holding up new fluid power applications; and (4) mass markets mean standardization, which is only feasible by mass production methods.

A part being produced in large numbers is shown in *Fig.* 1. In the top view is shown the original cylinder design. The cast iron or steel head is bolted to steel tubing which has been ground and honed. The oil port is drilled into the casting, although it may also be cored. An O-ring packing is used between the two parts. This, of course, is merely that part of the assembly which can be replaced by a cold extrusion. This particular type cylinder has been used in the last few years in annual quantities of 5000 to 7000. It is a low-power low-precision cylinder used on farm implements. Due to the farmers' acceptance of the fast, laborless hydraulic method of controlling their trailing implements, the requirement for 1954 may jump to at least 50,000 by one implement producer alone.

Fig. 2. (Above) Original 6-piece cylinder design included base, tubing, barrel, spacer and 2 bushings. (Below) One-piece extruded part.



The lower view of *Fig.* 1 shows the redesign permitting one-piece construction. The piston stop is in the center, and the annular inside shoulder is designed to cushion the stopping point. The thicker base permits direct drilling for the port opening, which, in the former cylinder, entailed two operations. Also, the outside diameter of the base is decreased and cylinder clearance has been considerably increased. No O-ring joint is necessary, so that one-half the possible leakage trouble is automatically eliminated. Furthermore, the redesigned cylinder is simpler, lighter and much stronger. It is 3½ inches ID, 3⅞ inches OD, 14⅞ inches long and weighs 17 lb.

Costly fabrication by welding a three-piece cylinder, similar to the one shown in *Fig.* 1, created a different problem in another case. This method of fabrication included boring and honing the tube, welding, joint inspection and assembly. All of these steps are avoided in the cold extrusion part. It is obvious that man-hours, machine time and other manufacturing costs were cut. In addition, the new cylinder, while cheaper, is also a better hydraulic container.

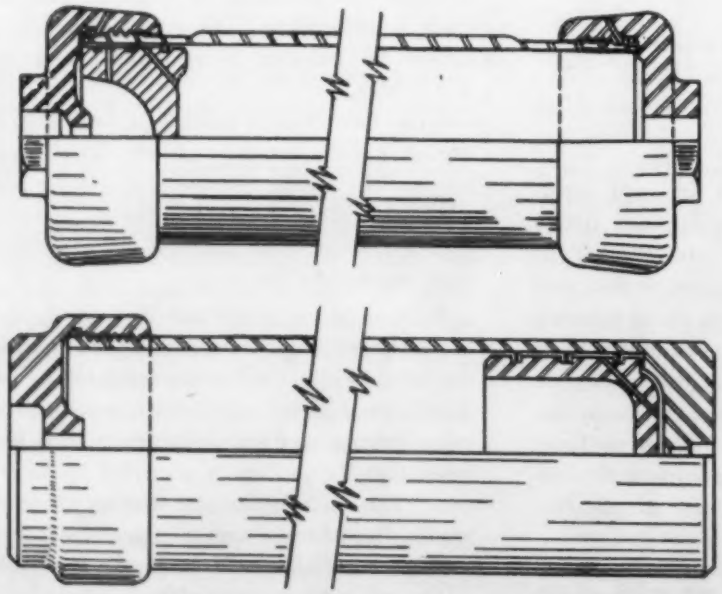


Fig. 3. Free-piston type hydropneumatic accumulator: (above) original design consisting of built-up assembly of many parts; (below) simplified design with extruded parts.

One of the most expensive commodities today is skilled labor. Tool engineers are constantly faced with the problem of reducing production costs.

An example of economies obtainable with one type of cylinder is illustrated in *Fig.* 2. This cylinder, used in large quantity, contained eleven separate parts, six of which are shown here. It required precise machining and threading as it operated at 4000 psi. No packing is used in the joints of the base, barrel and cylinder, and possibilities for leaking are great. The assembly and press fits of the bushings all take time and cost money.

The base was a casting. One end was turned and threaded, and two holes were drilled as shown. The tube was threaded on both ends and then assembled with the base. An oil-tight machined fit was mandatory between these two parts so no packing was used. The barrel, which was turned and threaded on one end, was then added. Two powder metal bushings and a spacer were then pressed into the barrel.

The one-piece redesign which replaced the six-piece design is shown in the lower view of *Fig.* 2. In this redesign, the following operations have been eliminated:

1. Threading tube at both ends.
2. Threading one end of base.
3. Threading one end of guide.
4. Machining (turning) one end of base.
5. Machining (turning) one end of guide.
6. Drilling center hole in base.

It is obvious that this cylinder will take more punishment without leaking or requiring maintenance. The open-end wall can be extruded to final size so that no machining of any kind is required except a drilled hole through the stud end to anchor the cylinder to the implement.

One of the first free-piston type hydropneumatic accumulators developed is shown in *Fig.* 3, top view. This accumulator was built by conventional methods of assembling tubing with separate ends. The new accumulator shell shown in the lower view is stronger, more precise and half as expensive to make. The free-piston type accumulator, developed to fill the new demands of industry is fast gaining in popularity; one reason is that it operates in any position. The cost of the old-type accumulator held up for two years one entire program of hydraulic starting devices employing air motors. Now with better, less expensive, reliable extruded accumulators, this program is going forward.

Mass production and standardization have proceeded hand in hand since the Industrial Revolution started. The redesigned accumulator shown in lower view of *Fig.* 3 can be extruded at the rate of 100 an hour on four 3000-ton presses.

A design that for nine months held up production of a new fluid power assembly is shown in *Fig.* 4. The design engineers wanted the shape exactly as shown, but were unable to find an economic method of mass production. The figure quoted for cold extrusion proved to be 1/2 to 1/3 that for any other method. The inside cavity, which had been thought imperative to machine, is formed cold. The thin walls are extruded to final dimensions without heat or any machining, being produced from a 5-inch diameter bar of SAE 1012 steel weighing 7.56 pounds. These are typical of the cylindrical parts that are being made by cold extrusion.

Operating procedures in production vary with the part. Some of the more complex parts require as many as seven operations. In some cases, two anneals are required, particularly where the percent reduction of a single operation or a culmination of operations exceed eighty-five percent. At times final sizing operations are desirable.

Lubrication in cold extrusion is important but, based on Mullins experience, it is not the key to successful mass production of cylindrical shapes. The real key is die design and sequence of operations, using pressures and speeds best suited in each step which, when properly applied, prove that carbon steel is a decidedly plastic material, capable of great formability.

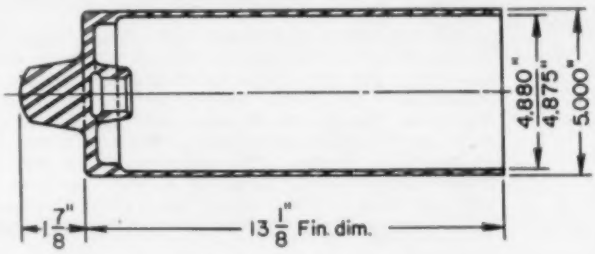


Fig. 4. Fluid power assembly, extruded to final dimensions.

So far most of the commercial applications have employed SAE 1010, aluminum-killed, hot-topped, shell quality steel. Alloys, stainless and nonferrous metals have not yet been extruded. The low-carbon steels are easier to handle and are capable of developing ultimate strengths up to about 115,000 psi. Although higher carbon steels have been worked, SAE 1010 or 1012 steels are much preferred. Higher-carbon steels work harden faster and more anneals are often required to achieve the final shape or size.

DESIGNED FOR PRODUCTION

Turret Drilling Machine Offers Savings

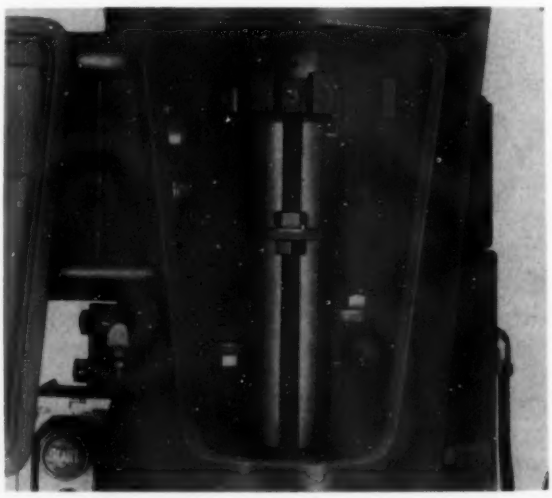
This recently marketed turret drilling machine offers savings in workpiece handling time, setup time, floor space, capital investment and maintenance. The machine represents eight years of development by Howe & Fant, Inc., East Norwalk, Conn.

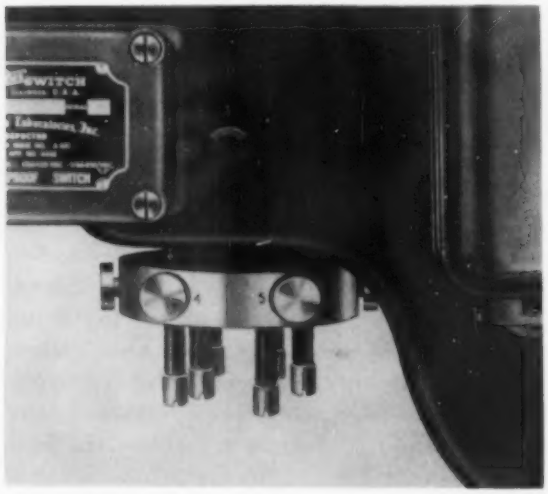
Up to six different drilling and tapping operations, in any desired sequence, can be done by a



THE TABLE, HEAD and handwheel of this turret drilling machine are adjustable to suit operator convenience and job size. The table travels vertically 18 inches and the head travels vertically 12 inches. The press handle can be rotated to and locked in the most comfortable operating position. Throat clearance is 14½ inches. This machine has a rigid box-type construction mounted on a cast iron base. Tool and jig wear is low because accurate alignment between tool and jig bushing is easily maintained.

TAPPING SELECTOR DOGS are flipped with a finger to give automatic reverse at twice forward speed for tapping at any spindle. Selected spindles reverse at bottom of stroke. To permit jog tapping, spindles also reverse when operating handwheel is raised. The dog for number 2 spindle is not set for tapping while that for number 1 is. In its lowered position, the dog for number 1 spindle will actuate the switch at the left when the spindle is indexed to the working position. Drilling or tapping depth of each spindle is controlled to within 0.002 inch by setting special depth stops. Depth of stroke ranges from 0 to 6 inches for each spindle. Depth stops and tapping selector dogs are conveniently located on the front of the counter-balanced head.

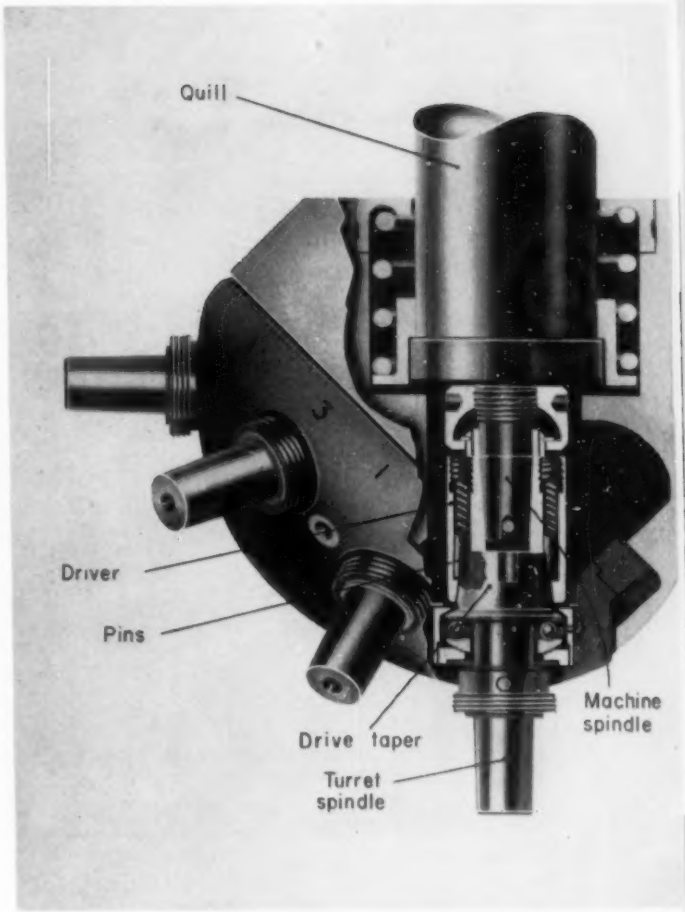




SPEED of each spindle can be preset to any value between 200 and 4000 rpm without special tools. Individual dogs are set to give the high or low range of the two-speed, 1-hp motor and thumbscrew controls pinpoint the desired spindle speed. Dogs and thumbscrews are numbered to correspond to those of the spindles they control.

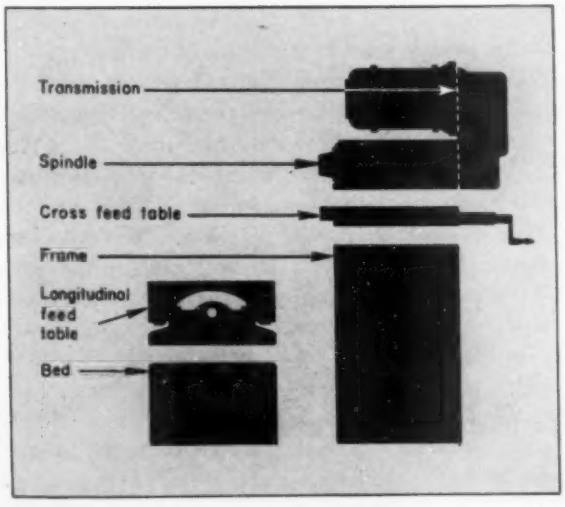
single operator at a single station. Speeds, depths and reversals for tapping are determined for each spindle at setup, and require no attention during successive operating cycles. This six-spindle machine requires no more floor space than a standard single-spindle drill press. All operating controls are conventionally located and easily reached from one operator position. The desired spindle is manually indexed to the working position, from either direction, by turning the turret head guard ring. Spindles can be used in direct sequence, or stations can be skipped.

Adjustment components are all keyed to the spindle they control so no errors are made during setup. The quill is chrome plated and precision ground, and features preloaded ball bearing construction. It is counterbalanced for high sensitivity.



THE DRIVER automatically releases the turret spindle during the last ¾ inch of upward quill movement. The turret can then be indexed in either direction to any station without stopping the motor. As the quill is lowered, the drive taper aligns the turret spindle with the machine spindle. Simultaneously, two spring-loaded pins engage slots in the turret spindle and form a positive drive connection. Tools are held in standard ½-inch chucks and a tachometer indicates the speed of the operating spindle. Visual markings and a ball detent guide make turret indexing positive. Only the working spindle revolves. All others point away from the operator.

Machine Tools Built From Standard Subassemblies



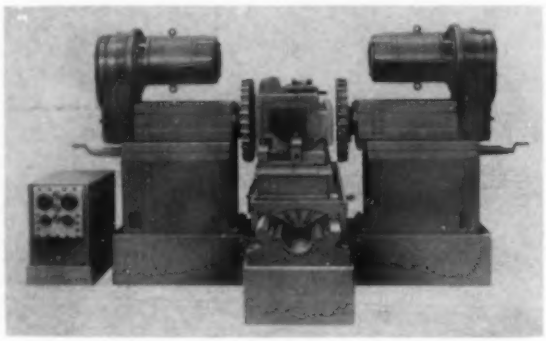
Because both special purpose and universal machines have technical and economic limitations, Henschel & Sohn, Kassel, Germany, has analyzed machine tools, separated them into functions and developed standard units. Each function is represented by a range of standardized subassemblies, distributed in the U.S.A. by Manufacturers Associates, New York, N. Y., that can be combined by

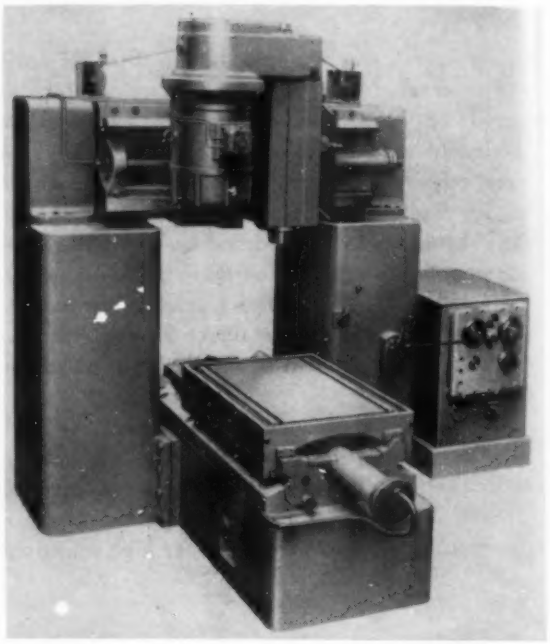
STANDARD SUBASSEMBLIES are available in either three or four basic sizes or ranges, and can be combined for milling, drilling, boring, multiple boring, counterboring, reaming, threading and tapping. Design of individual units combines simplicity, compactness, ruggedness, and high precision. Units can be arranged horizontally or vertically, and can be adjusted in either plane. In addition to units shown, standard hydraulic and V-belt subassemblies are available.

the user for either special or general purpose use. When a combination for a special purpose has outlived its usefulness, because of production program or part design changes, it can be modified or broken down into its components for re-use.

Because special purpose machine tools can be erected from standard units, high development and construction costs, usually associated with single unit special purpose tools, are avoided.

TWO SPINDLE planer type milling machine is made up of: 2 spindles, 2 transmissions, 2 cross feeds, 1 longitudinal feed table, 2 pedestals, 1 bed and 1 hydraulic unit. The work table is 79 inches long by 28 inches wide with a feed length of 67 inches. The spindle noses are 10 inches above the table.





UNIVERSAL FACE MILLING MACHINE comprises the following standard units: 1 spindle, 1 transmission, 1 cross feed, 2 longitudinal feed tables, 3 pedestals, 1 bed and 1 hydraulic unit. The machine can be used for face milling any workpiece that can be located within range of the spindle. The usable horizontal feed is 36 inches; traverse, 24 inches, and vertical spindle movement, 8 inches. Feed of the traverse and work tables can be regulated steplessly, and the speed of the milling spindle can be varied with change gears from 35 to 710 rpm.

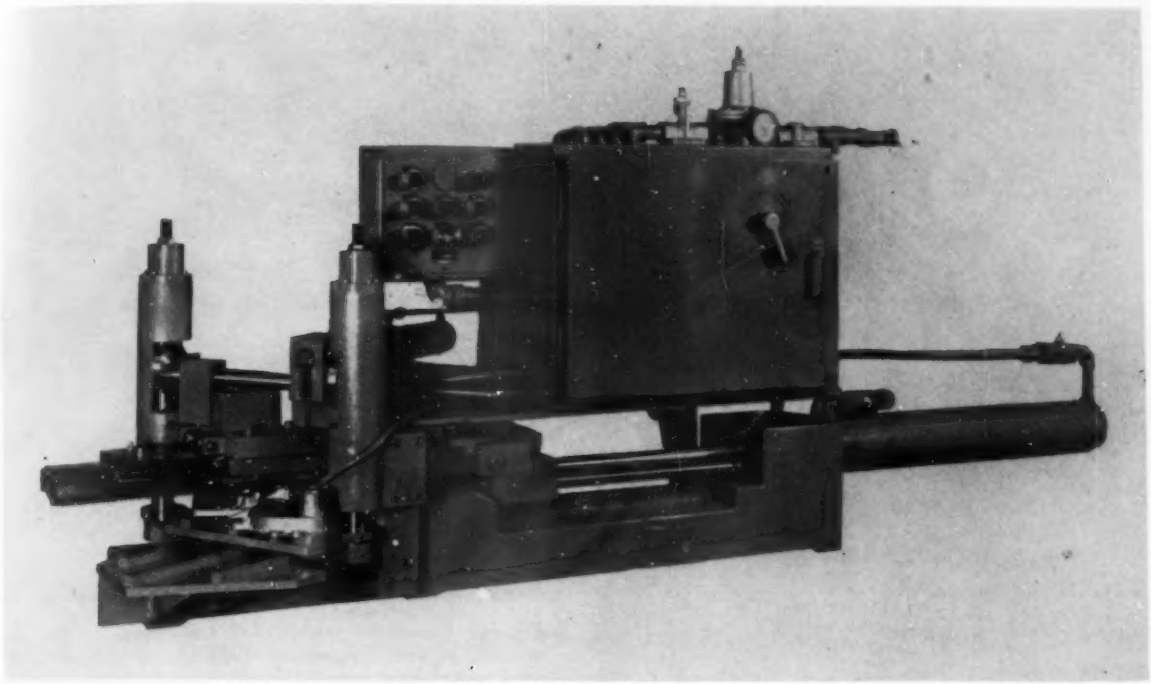
Broaching Two Nonparallel Slots Simultaneously

A new air-powered horizontal broaching head designed and built by National Broach & Machine Co., Detroit, Mich., simultaneously broaches two nonparallel slots in a die-cast aluminum washing machine gear case cover. The $\frac{1}{8}$ by $\frac{1}{8}$-inch slots, which are provided in the part to guide control bars, are located at a 10-degree angle to each other. The new head permits production of the slots in a fraction of the time required by a former double milling operation. Only 8 seconds are required to load, broach and unload the part.

Simultaneous broaching of the nonparallel slots is achieved by an unusual broach puller design in which each broach is attached to individual angular-mounted shafts on the puller head through universal joint type yokes. The yokes are mounted on their shafts with linear ball bushings that permit free sideway movement of the yokes in relation to each other. The 12-inch long broaches are clamped in broach holders, to facilitate removal for sharpening, that are guided in slides above the part. As the broaches are pulled through the angular slots, they are guided in the correct angular paths.

To broach the two slots, the gear case cover is loaded over a locating pin and swung under the broaches against an interlocked precision switch that indicates correct radial location. With the part in position, the cycle "start" button is pressed and the automatic broaching cycle is initiated. An air cylinder-controlled rack, pinion and eccentric cam mechanism raises the platform carrying the part. A spring-loaded clamping plunger locator enters a hole in the part from above. An adjustable stop controls the vertical travel of the platform to provide the broach depth adjustment.

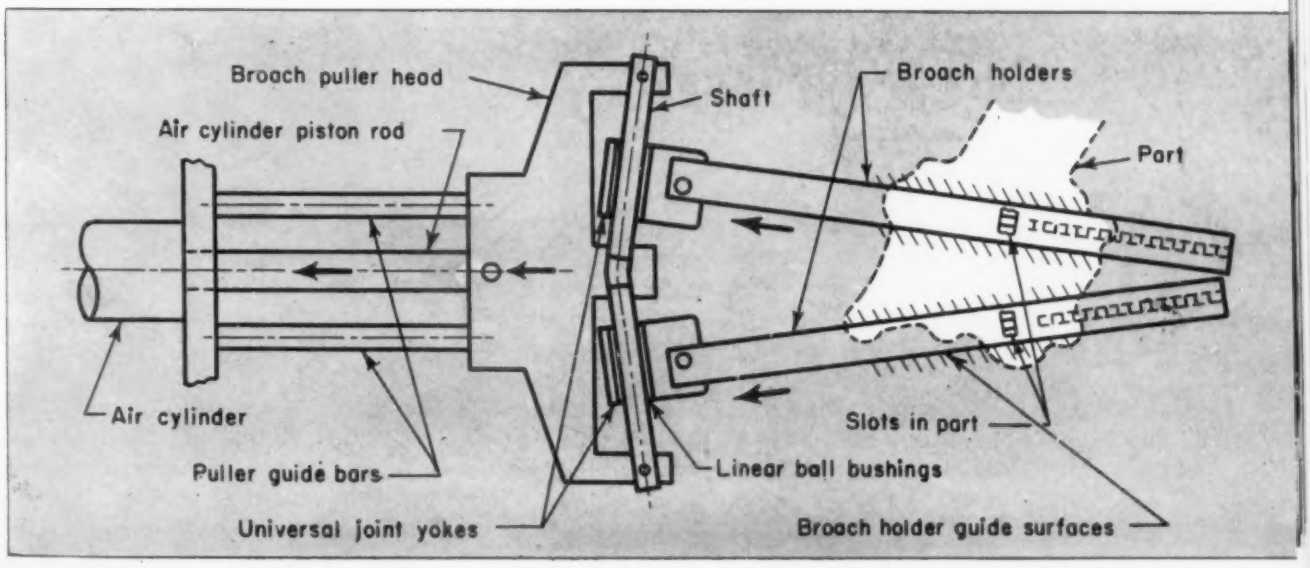
When the platform reaches the end of its vertical travel, another precision switch is contacted to start the broach cutting stroke. An air cylinder attached



SPECIAL BROACHING HEAD on a standard horizontal broach permits simultaneous cutting of two non-parallel slots in a die-cast aluminum housing. An automatic broaching cycle, including the raising of the table holding the part, is initiated by pushing the "start" button. The part is automatically positioned and clamped.

to the head pulls the broaches through the part. When the broaches reach the end of their cutting stroke, another switch is actuated, the platform drops, the broaches return to initial positions and the part can be unloaded from the fixture. Chips are removed from the broaches and work both during and following the broaching operation by automatically controlled air blasts.

SCHEMATIC DRAWING of the head shows how linear ball bushings and universal joint yokes permit one air cylinder to pull two guided broaches simultaneously across the part in angular paths. Only 8 seconds are required to load, broach and unload the part which represents large savings in time over former double milling operations. Broaches are clamped in holders that are guided by slides.



sealing porous castings

By Wilson N. Pratt

Director of Research
American Metaseal Mfg. Corp.
West New York, N. J.



Fig. 1. Complete system for impregnating porous aluminum and magnesium castings so they can be used in pressure service.

INCREASED PRESSURES AND STRESSES imposed by modern high-speed and high-altitude flight have considerably raised the requirements for aircraft and aircraft accessories. The reliability of a plane and the safety of its occupants may well depend on the operation of a pressurization or air cooling unit. Efficiency of cast components for such units depends in part on complete pressure tightness. Metal porosity, from which leakage develops, is one of the problems that must be solved by manufacturers of aircraft equipment. Several other problems, of interest to the aircraft and other fields, are solved at the same time by impregnation.

Electrolytic corrosion attacks porous areas by forming an "electrolytic circle" between the walls of each micropore. This causes the pores to enlarge greatly, leads to connected porosity and internal corrosion, and results in leakage and eventual failure of the part. The purpose of an impregnant is to fill the surface-connected micropores, prevent the entrance of corrosive chemicals and break the electrolytic circle.

Impregnation of castings for pressure tightness is not new but new impregnants are increasing the utility of the process. Metaseal 19V5, for example, is basically a thermosetting polyester resin (styrene copolymer with little styrene) with a maximum shrinkage of 2 to 3 percent. This modified resin has two basic advantages over normal polyester resins: (1) it requires no refrigeration during storage because it does not gel at room temperature and (2) it is not inhibited by copper and can therefore be used in copper-base alloys or come into contact with copper equipment without losing its effectiveness. Because it has high wetting power, the impregnant is composed of 100-percent solids and contains no solvent. Viscosity of the material is constant, requiring neither agitation nor aeration. Viscosity of this material is such that bleeding from the pores of castings during the cure is minimized. The cured resin is resistant to a wide range of acids, solvents and other chemicals.

Aside from preventing loss of pressure, impregnation aids in the finishing of porous metals. Both organic and inorganic finishes can fail because of the exudation of internal corrosion products. Cleaning and plating solutions can be trapped in micropores and result in failure of a plated surface.

When parts are impregnated before finishing, these failures cannot occur because the micropores are already filled with a solid material. This applies to painted ferrous and nonferrous metals, anodized aluminum, dichromated magnesium and plated sintered parts. Anodizing can be done before or after impregnation but the best corrosion resistance results when the part is impregnated both before and after anodizing.

The modified resin is invisible upon application and all surplus material is removed prior to the cure. Critical tolerances or machined surfaces are not affected by impregnation. Impregnated castings can be machined without fouling tools. The cured resin can resist intermittent temperatures in a range between −75 and +500F, and constant temperatures up to 400F. Curing time varies with casting design and size, and curing temperature, but is about two hours for an average casting at 275F and about three hours for an average casting at 250F.

The Stratos Div., Fairchild Engine and Airplane Corp. prevents leakage in sand cast and die cast magnesium and aluminum aircraft accessory housings by impregnating them. Because the process has proved successful, all housing castings are impregnated routinely. Stratos has found it less expensive and more effective to impregnate all castings than to determine which are porous and which are not.

This company produces pressurization and air conditioning equipment, air turbine drives and other accessories for airplanes. The sand cast magnesium gear cases for air turbine drives that power generators on jet planes must withstand pressures up to 100 psi. Various aluminum castings of the air cycle refrigeration systems, used to cool compartments and pressurize cabin interiors on jet bombers, must withstand pressures up to 75 psi, while the sand cast magnesium outlet duct is subjected to temperatures up to 600F and pressures up to 75 psi. All aluminum sand castings are machined and anodized before impregnation, and magnesium sand castings are manodized or dichromated before impregnation. Aluminum die castings are anodized before impregnation.

Stratos selected the modified polyester resin as an impregnant because it meets Military Specification Mil-I-6869, which states that impregnants used in aluminum and magnesium castings must be capable of producing a solid, continuous structure. A hub unit system, *Fig.* 1, was selected because it is designed for simple one-man operation.

After thorough solvent cleaning, parts are warmed to completely dehydrate them. Castings are then loaded in a basket so they can be handled

Fig. 2. Final wash tank contains clear water. Batch of parts in basket is agitated by an air mechanism located in the hoist. Tank in foreground contains the emulsifying cleaner.

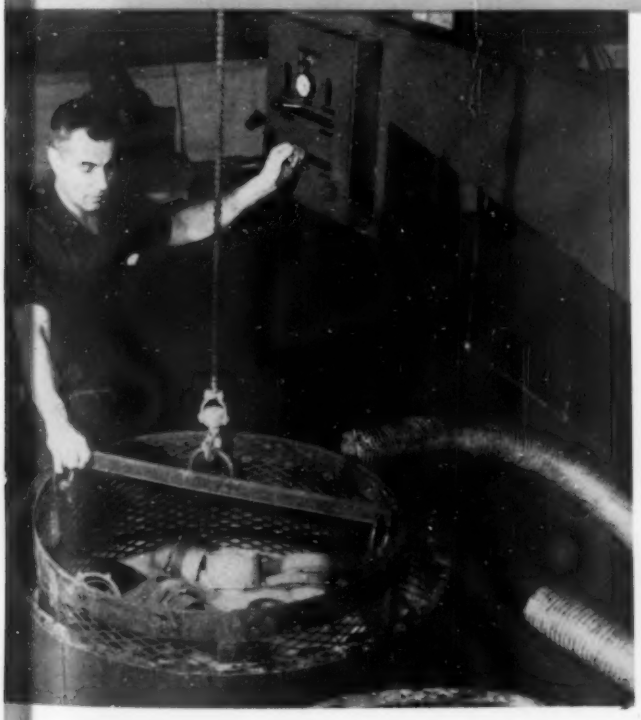


Fig. 3. After batch treating and cleaning, parts are inspected and blind tapped holes blown out with water to remove all traces of the impregnating resin from the surface.





Fig. 4. Typical impregnated aircraft accessory parts include, from left to right in top row: turbine housing for a cooling unit, gear case housing for a drive turbine and an air moisture separator drain housing; bottom row, turbine outlet fairing and heat exchanger outlet duct for a cooling unit.

in batches. The basket is picked up by the power hoist, which rotates around the central column with the control panel, and deposited in the first autoclave. A vacuum is drawn in the autoclave and any pore connected to the casting surface is evacuated. At this time, the impregnant is introduced into the autoclave without breaking the vacuum.

The liquid impregnant is stored in the second autoclave until it is needed in the first, at which time it is piped through a connection under the floor. After an initial dwell period, positive pressure is applied to the top of the autoclave and impregnation is forced. While the parts in the first autoclave are treated, another basket of clean parts is lowered into the empty, second autoclave. By the time the required vacuum is drawn in the second autoclave, parts in the first are impregnated and the impregnant is run to the second autoclave.

At the end of the cycle, pressure is released and the basket is transferred to the mechanical surging tank. This tank is filled with a special, emulsifying cleaner that removes excess impregnant from the surfaces, including those of blind taps, threads and channels, without removing the resin from the pores. The basket of parts is agitated in this and the succeeding tank by a small air mechanism located at the top of the hoist. The final washing tank, *Fig.* 2, is filled with clear water.

The treated parts are removed from the basket to a draining, inspecting and cleaning table where each casting is inspected and blind tapped holes are blown out with water, *Fig.* 3. After cleaning is complete, the parts are heated so the absorbed liquid impregnant is polymerized to a solid.

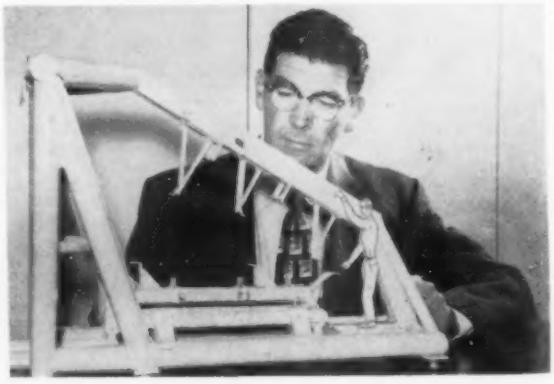
This treatment results in parts, *Fig.* 4, that do not develop leaks during pressure service. Structurally sound impregnated castings can be pressure tested to destruction without leakage.

Miniature Fixtures For Tooling Economy

TOOL ENGINEERS at Chance Vought Aircraft plan the giant jigs and fixtures on which wings, fuselage and other parts of a new plane will take form on tiny scale models such as this one illustrated, made of aluminum and steel tubing.

Since the eventual framework will be a heavy, expensive piece of industrial equipment, its construction can be planned ahead and redesigned if necessary by use of these models, thus avoiding expensive revision and rebuilding.

The small fixtures are scaled down from exact measurements of preliminary tool design blueprints.



Scale model aircraft jig used to plan construction of full-sized jigs. Note scale model of workman.

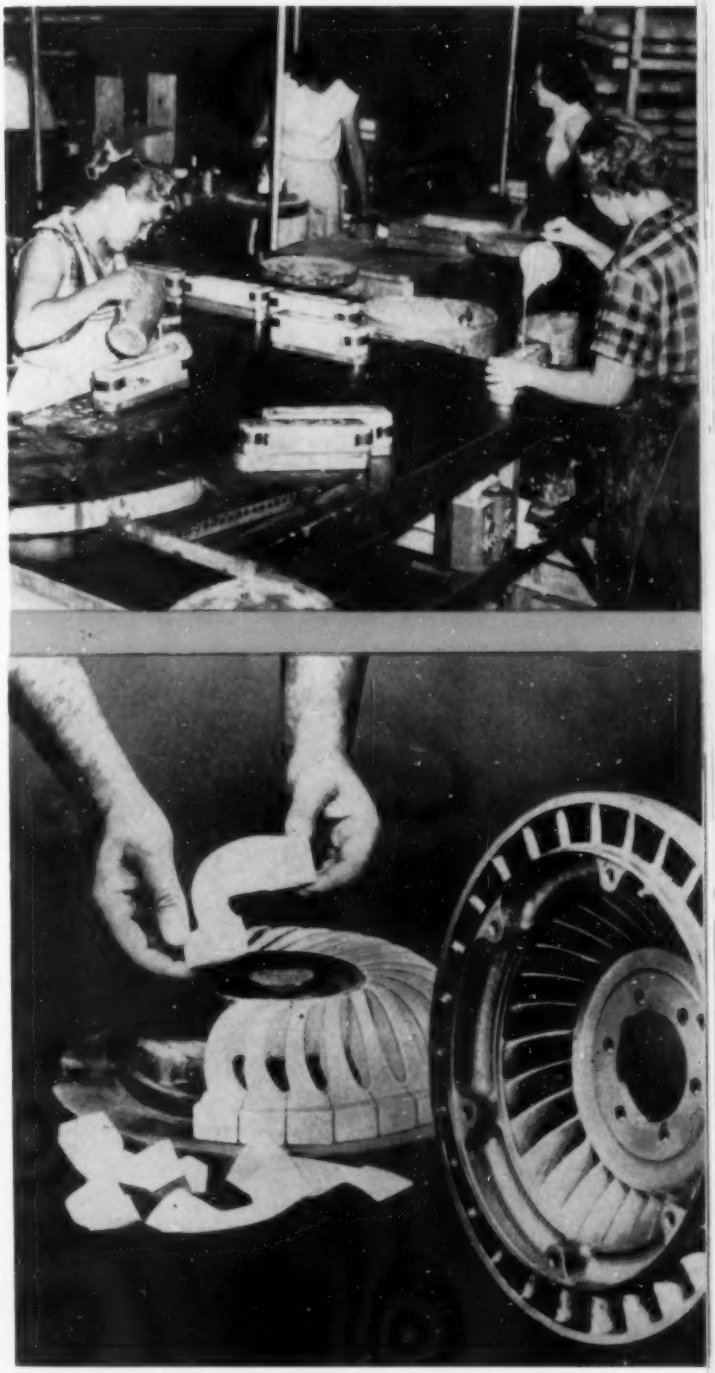
Improved Plaster Castings Broaden Foundry Practice

With the perfection of a plaster casting process, design possibilities of aluminum and magnesium castings have been extended to a degree that makes it possible to produce small and intricate parts in the foundry. In the process now in full use at Aluminum Co. of America, where it was perfected, plaster joins sand and iron to make a permeable mold material that allows casting of thin aluminum parts with cross sections that turn out with an excellent surface smoothness. Further, accurate dimensional tolerances can be met with the process. Physical properties possible to achieve with the permeable plaster appear equal generally to those provided by aluminum sand castings. Plaster mold components are already used extensively for torque converter parts, and this appears only the beginning of applications for volume production of small castings such as small bearings and hardware parts.

However, the process need not be limited to small parts. Alcoa already has used the plaster mold components with sand or permanent mold materials to produce composite mold castings. This procedure allows the designer to specify surface and dimensional accuracy only where it is needed.

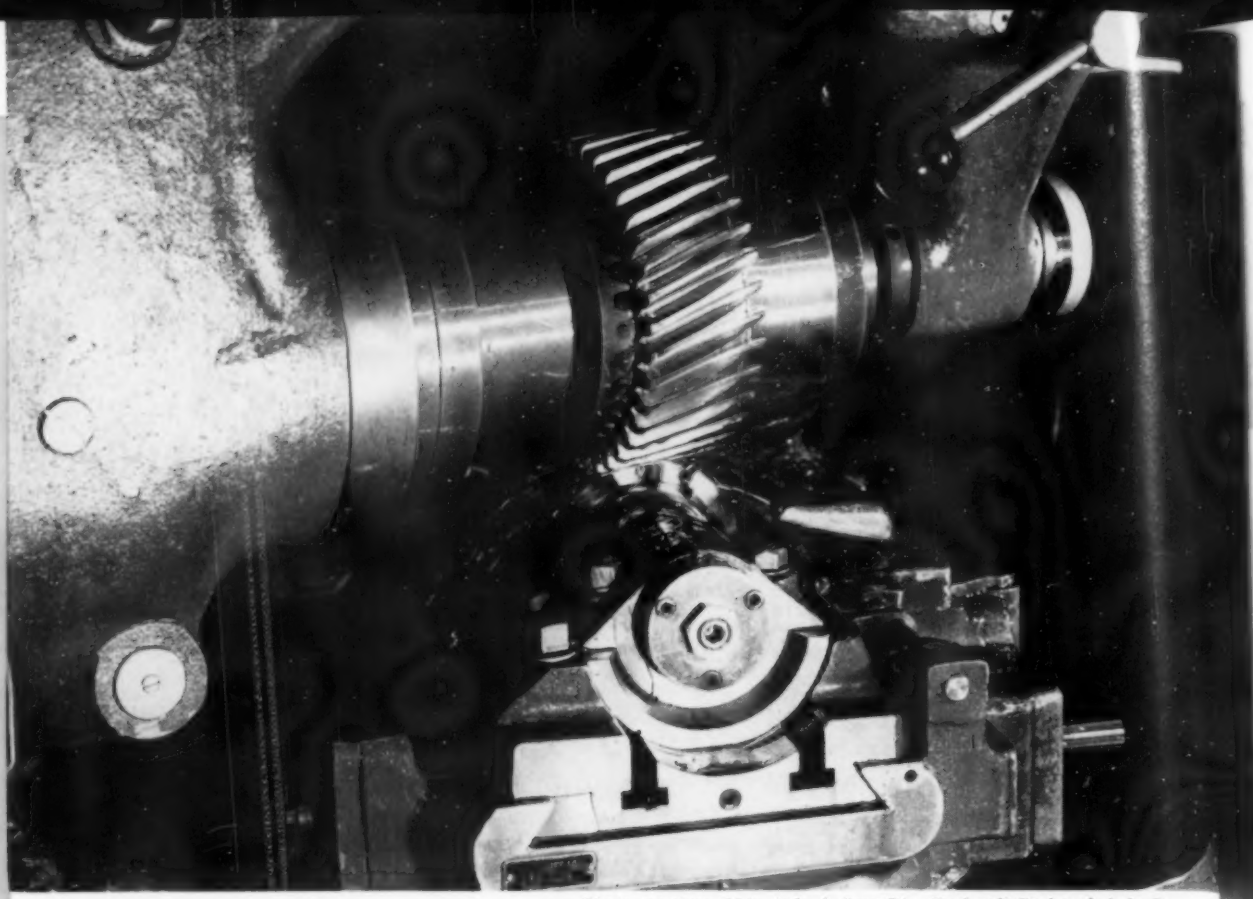
While the plaster process will not match fine machining tolerances, it is sufficiently accurate to avoid machining that is often required with sand or permanent mold.

Tolerances possible generally with this new process are ± 0.010 in. across the parting line for one inch or less. Between points produced in one part of the mold ± 0.050 in. tolerance is possible. A nominal surface finish of 125 rms or better can be achieved by using the plaster process.



Pouring plaster (upper right) into core boxes to form the necessary plaster mold components.

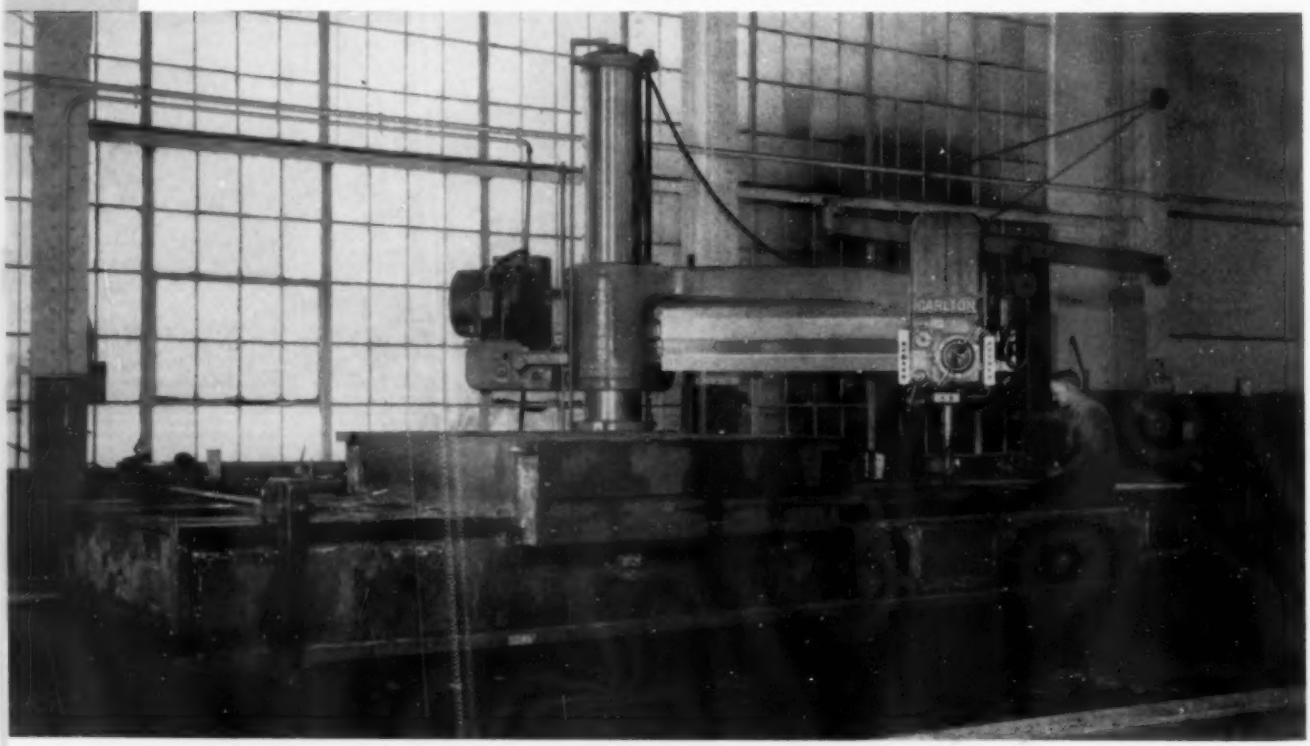
Plaster casting process (lower right) used in the production of automotive torque converter castings. Plaster cores, left, form the casting blades, right.



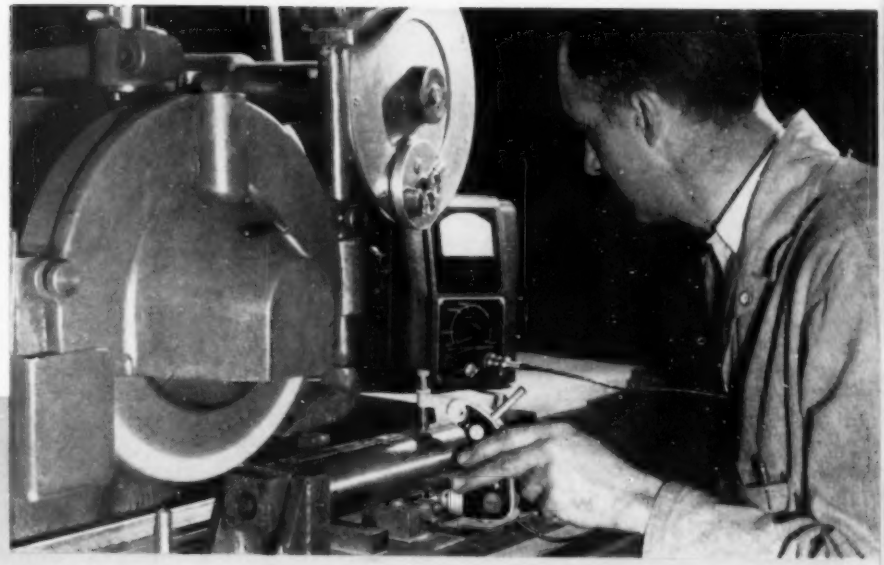
—Photo courtesy Ohio Axle & Gear Div, Rockwell Spring & Axle Co.

CUTTING at 275 surface feet per minute, a horizontal, differential-type gear hobber is producing two helical transfer case gears with a combined face width of 5 inches. Feed is 0.045 ipr and floor-to-floor time for the two gears is 19 minutes. Gear stock is SAE 94B17 steel normalized to 135-175 Brinell.

DRILLING 75 leveling screw holes in one setting in the 65,260-lb bed casting for a large horizontal boring machine is facilitated by the sliding bed plate base of this Carlton radial drill. This special mounting enables the radial drill arm to cover the entire 22 by 8 by 4-foot drilling area.

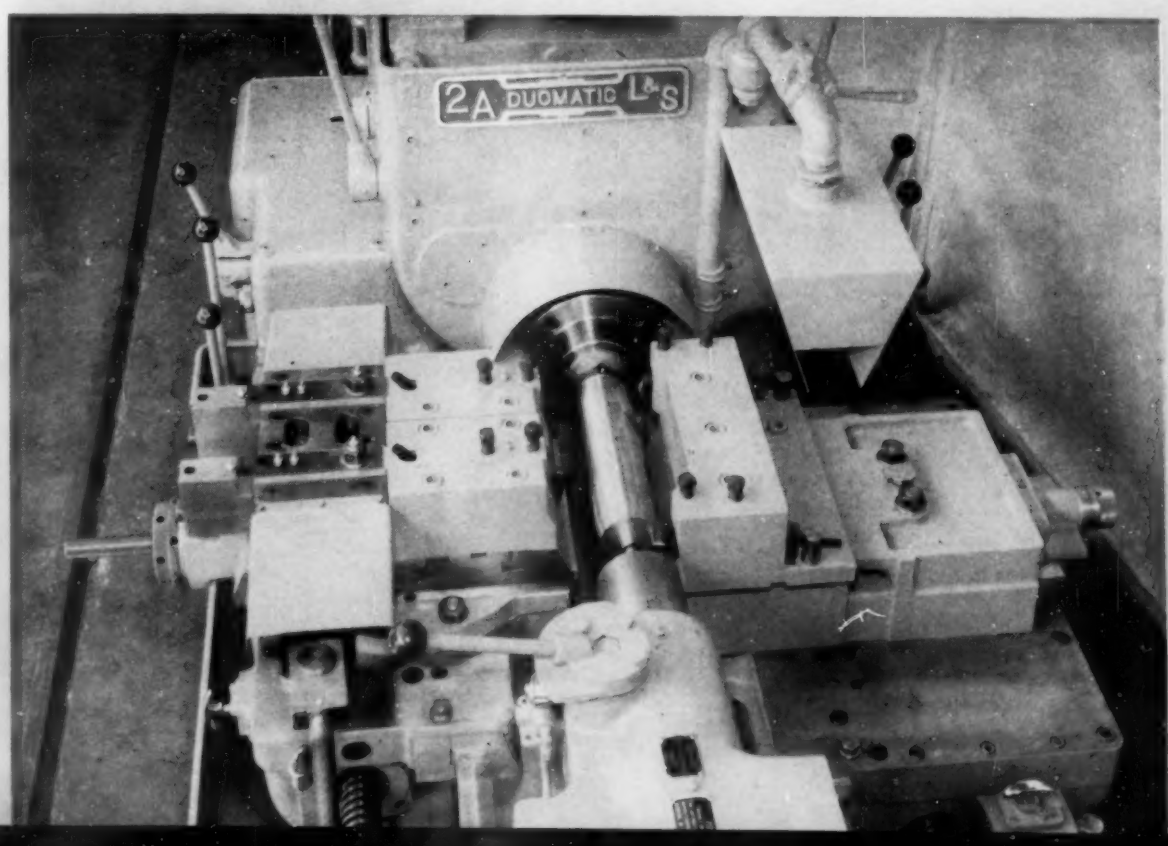


TOOLS at work

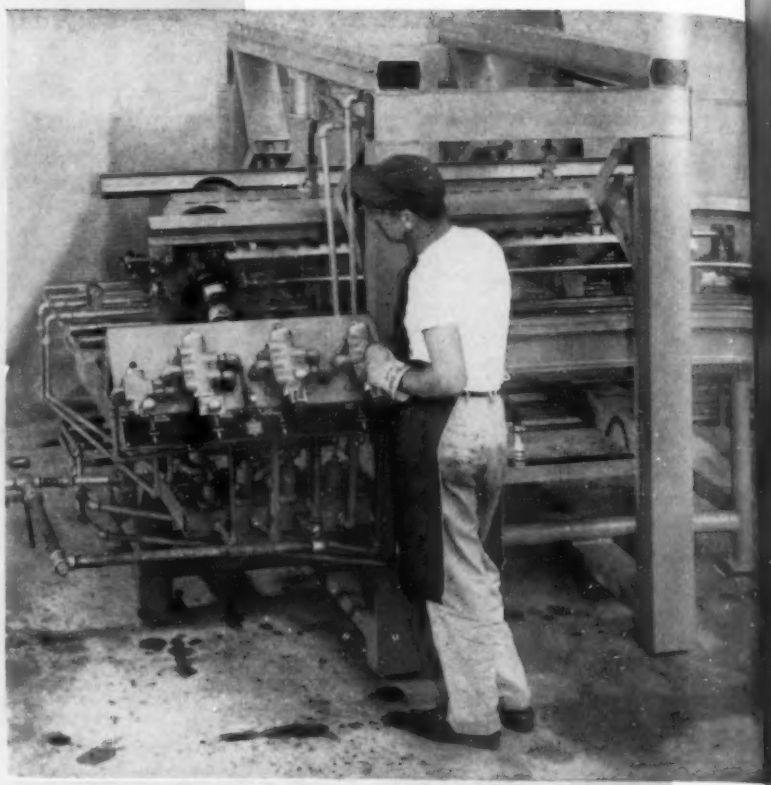


HELD IN A SPECIAL fixture on a surface grinder, a turret slide feed bar is checked with Brown & Sharpe electronic caliper and amplifier for parallelism of over-all diameter. Variable allowance is from 0.00025 to 0.00050-inch.

FOUR OPERATIONS (semifinish turn, face, form and chamfer) are completed simultaneously on 76-mm shells at The Murray Co., Dallas, Texas, in this semiautomatic setup in a Lodge & Shipley lathe. The workpiece is driven by an air-operated 3-jaw expanding mandrel and is located automatically. Two turning tools on the front slide are guided by a special cam to generate the straight and tapered diameters. Facing and forming tools on the rear slide follow a simple "in and out" cycle. Production of 41 pieces per hour is achieved.



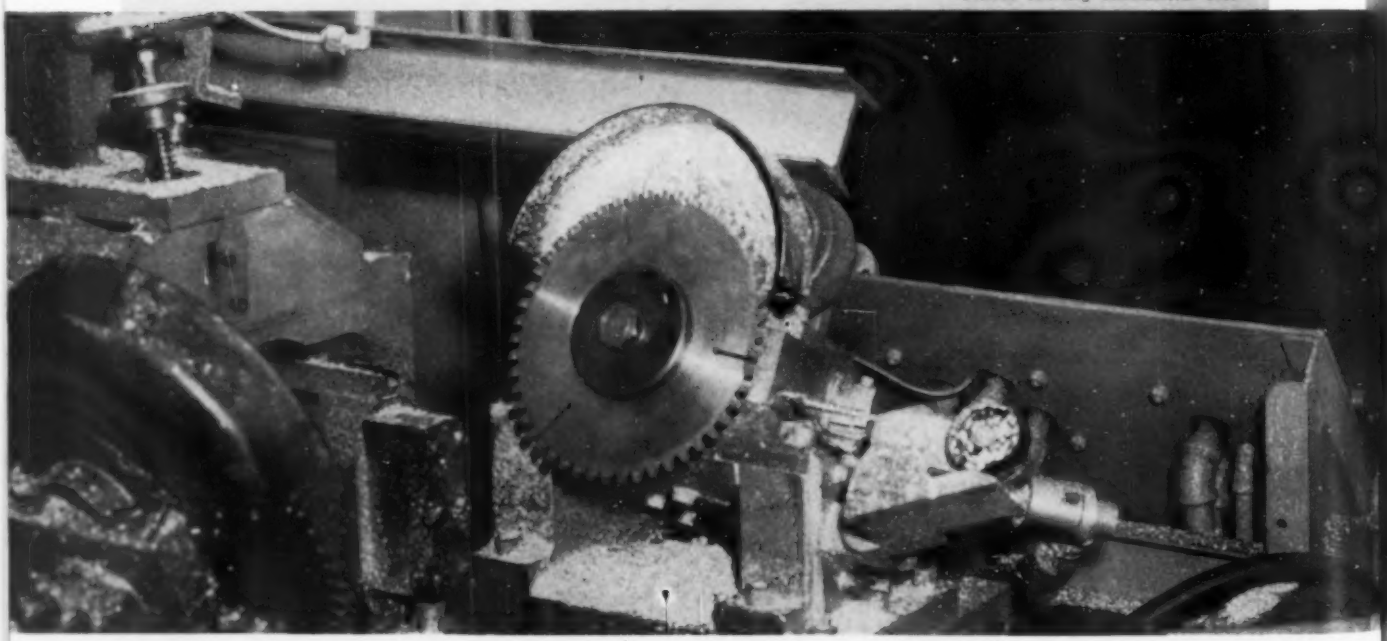
TOOLS at work



PRODUCTION OF WING-TIP gas tanks was stepped up at Fletcher Aviation Corp., Pasadena, Calif., by by means of this special twin-power saw. One operator and helper now turn out 300 double cuts in a shift. Before development of the unit 4 men with hand-operated routers could complete only 150 cuts per day—resulting in a serious bottleneck. The saw is powered with two 3-hp motors, which turn 8-in carbide saws, shown more clearly in the close-up below.

PRECISION FIT of the wing tank mounting depends on the cut made by the saws. The workpiece is 6 feet long, 1/8 inch thick, 3 SO aluminum. The saws turn at 3000 rpm and a 25 feet per minute rate of feed is used. Hydraulics and compressed air are combined to maintain smooth driving power.

—Photos courtesy Kennametal Inc.



latest methods

for magnetic work holding

By Frank Suchanek

Field Engineer
Sundstrand Magnetic Products Co., Rockford, Ill.

FERROUS MATERIALS provide efficient paths for the completion of magnetic circuits. It is this fact that governs the design and use of magnetic holding devices. For any ferrous material to be firmly held by a magnetic chuck, *Fig.* 1, it must be placed in contact with unlike magnetic poles to provide an efficient flux path.

Magnetic chucks are of two basic types: permanent and electromagnetic. Materials these chucks hold can be classed as magnetic (iron, steel, nickel and cobalt), paramagnetic (aluminum, platinum and manganese) and nonmagnetic. Magnetic response of magnetic materials differs and that for paramagnetic materials is insufficient for holding against normal machining operations. Temperature affects the magnetic properties of magnetic materials (iron and steel fail to respond after being heated to 1200F) and alloying elements further complicate response patterns.

Permanent magnets are mounted on a sliding rack so they can be moved under the grid-plate working surface of the magnetic chuck. In the "on" position, the magnets are close to the grid plate; in the "off" position, the magnets are retracted below the grid plate and the magnetic circuit is completed within the plate. This type of chuck can be used in light grinding responsive materials. Chucks of this type seldom have work areas larger than 8 by 24 inches. Some alloy steel parts are difficult to remove because of residual magnetic effects.

If there were no flux dams in the top plate of electromagnetic chucks, as at A in *Fig.* 2, most of the flux lines would complete their magnetic circuit within the top plate and few would be available for holding the workpiece. When dams are intro-

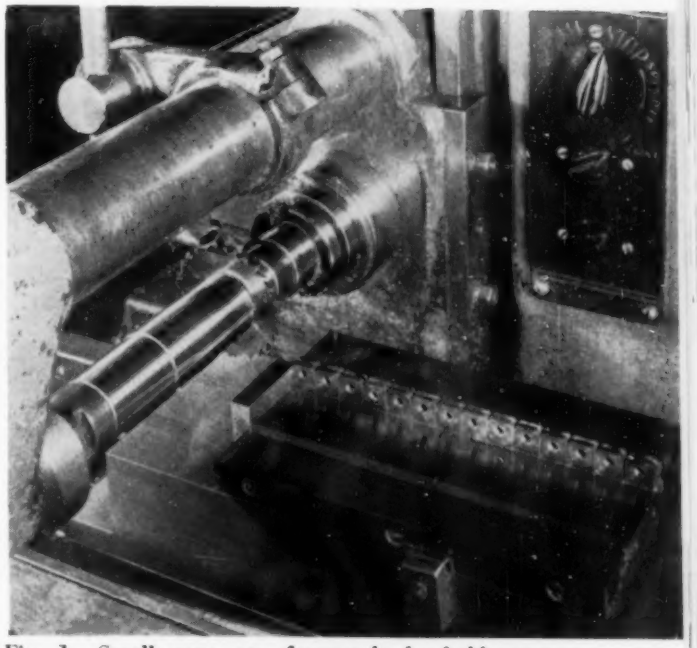
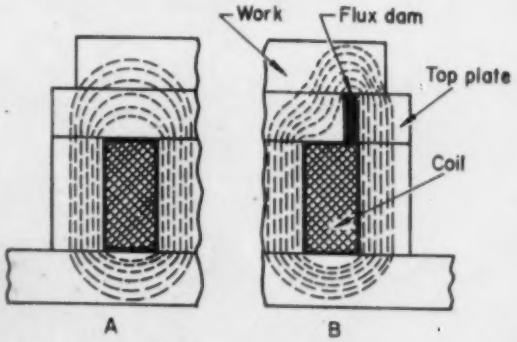


Fig. 1. Small parts can frequently be held magnetically with appreciable savings as are these 14 parts aligned for a slotting cut.

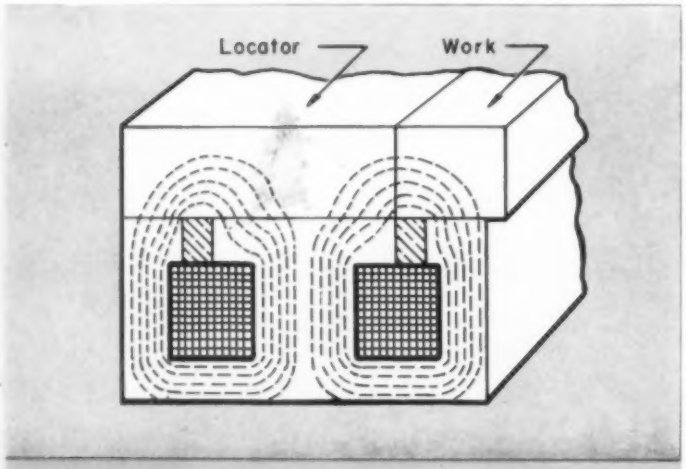
Fig. 2. Without a flux dam, A, most of the magnetic circuit is wasted in the top plate. With dams, B, lines of flux are directed through to hold the workpiece.

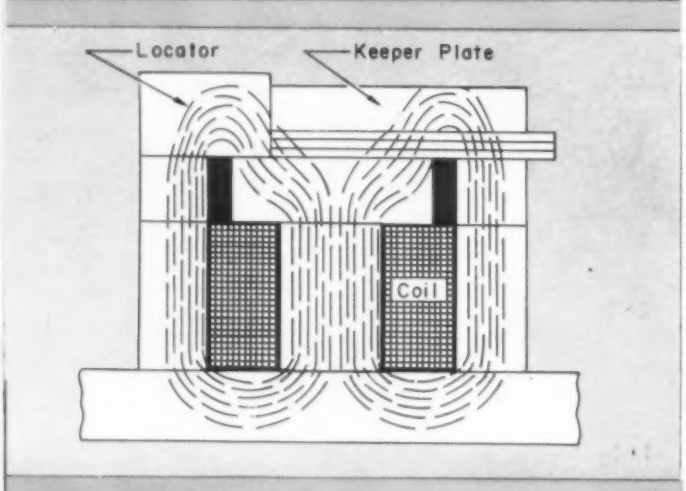


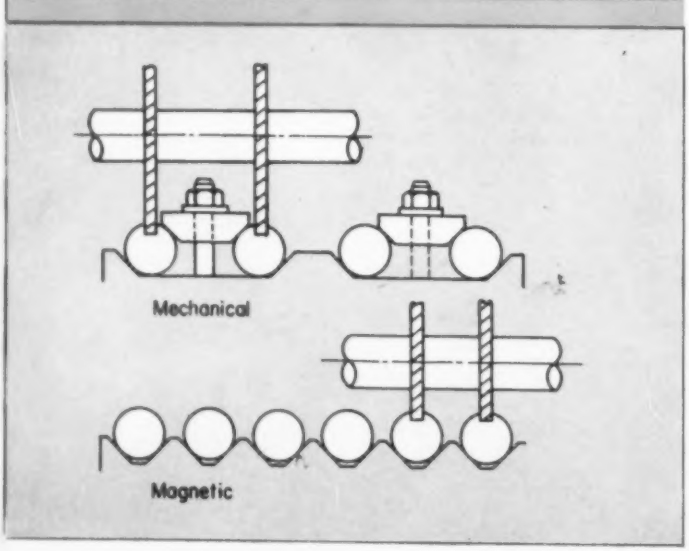
Abstracted from paper 22T9, "Magnetic Holding of Ferrous and Nonferrous Materials," presented at the 22nd ASTE Annual Meeting. Copies of the complete paper are available from Society Headquarters.

duced, as at B, the flux lines are directed through the workpiece and holding power is maximum.

The most common type of electromagnetic chuck has the axis of the coil cores and the flux dams laid crosswise. This pole pattern serves the average need in production and toolroom grinding, and other light milling and planing operations. A second type of pole pattern is expanding the application of magnetic chucks to heavy milling jobs, crush form grinding and other heavy duty work on planers, shapers and special machines. This pattern has longitudinal poles and the flux dams are laid parallel to the longitudinal axis of the chuck. This design provides uniform holding action from one end of the chuck to the other. This is important because it provides a convenient way to direct a greater quantity of flux through the part to be held. Also, there is no measurable loss of holding power through use of auxiliary fixtures such as parallels, V-blocks and special adaptors for odd shapes.







Electromagnetic devices are being used for increasingly difficult holding tasks. For example, the rough, as-cast surface of a Meehanite part is being held for a face milling operation where the feed rate is 14 inches per minute at a $\frac{1}{4}$-inch depth of cut. It is also frequently practical to mill magnetically held small parts as in *Fig.* 1. The parts are $\frac{5}{8}$ by $\frac{5}{8}$ by $\frac{5}{16}$ inch in size. Machining costs were prohibitive when these parts were clamped in a mechanical vise so the $\frac{1}{2}$-inch deep 0.090-inch wide slots could be formed. In the magnetic fixture now used, the parts are aligned by a parallel that is set over one of the flux dams. The setup is for climb cutting with a feed rate of 13 ipm.

For one small part, the locator is aligned adjacent to the flux dam and holding is accomplished on the face of the magnet and the vertical face of the locator, *Fig.* 3. This represents a two-way holding circuit. Another two-way holding circuit is used to permit machining of nonmagnetic materials. The workpieces are placed over a flux dam and aligned by a locator, *Fig.* 4. A keeper plate is then placed on top of the workpieces.

One of the chief factors leading to replacement of mechanical by magnetic holding devices is the saving in time and effort that can be realized. An example of this, and other advantages, is found in the production milling of keyways in shafts, *Fig.* 5. When shafts are placed in a magnetic V against a rigid end stop and set up for climb cutting, the keyways are easily milled at feed rates of 5 to 16 inches per minute. Elimination of conventional clamps makes it possible to place more shafts on the table or use a smaller table. A considerable saving is also obtained because smaller diameter cutters can be used.

Fig. 3. (top) Two-way holding circuits exert a holding force through the face of the magnet and through the vertical face of an auxiliary member, such as a locator.

Fig. 4. (center) Nonferrous materials can only be held by magnetic fixtures when magnetic materials can be included in the circuit.

Fig. 5. (bottom) Electromagnetic clamping requires smaller tables for the same number of milled keyways and permits use of inexpensive, small cutters.

thin-walled extrusion

on the Drill Press

By W. N. Parker

Development Engineer
Tube Division
Radio Corporation of America

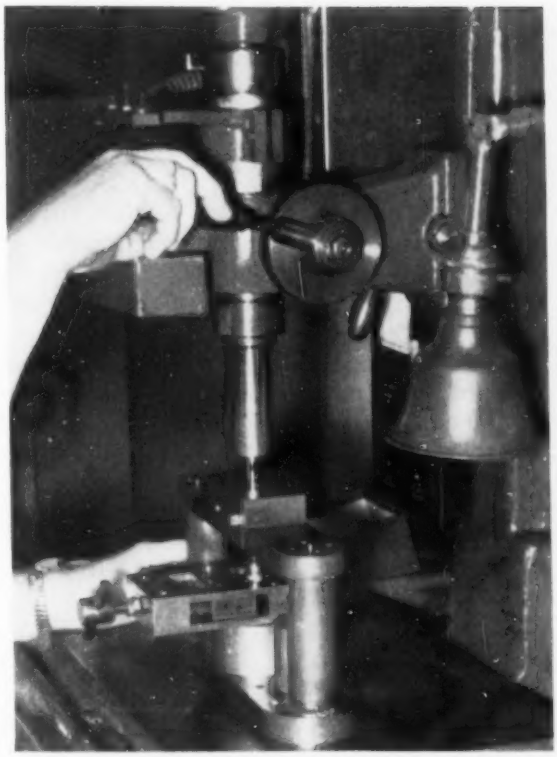


Fig. 1. Extruding thin-wall tubing on a drill press. Self-centering jig contains three rollers turning on sixteen 0.0625-inch diameter needle bearings. One roller is adjustable to produce wall thickness reduction. A light pressure extrudes part in a few seconds.

MANUFACTURE of fragile, cylindrical parts is difficult and expensive because thin walls crush easily and tolerances are difficult to maintain. Uniskan extrusion, a metalworking process developed by the Radio Corporation of America, rapidly extrudes seamless electron tube components to a wall thickness under 0.001 inch. Similar techniques can be applied to extrude any thin tubular part.

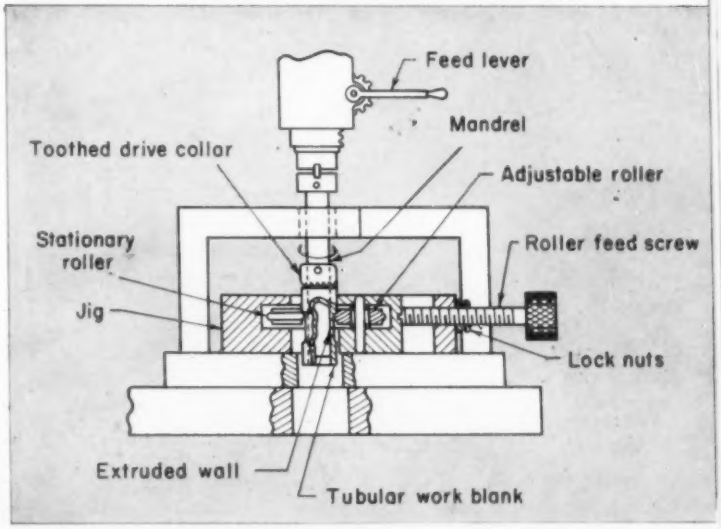
Equipment consists of a small drill press and a relatively simple jig, *Fig.* 1. A short tubular work blank is inserted over a mandrel and both are rotated in the drill press. A toothed collar, *Fig.* 2, attached to the spindle turns the work blank. The mandrel is accurately aligned by turning in a separate bearing. Three self-centering rollers, one of which is adjustable, are contained in a jig. By turning a knob on the feed screw, the adjustable roller is forced into the rotating blank to form the desired wall thickness. Light axial pressure of the feed lever extrudes the wall for a predetermined length.

Fabrication Process

A convex bead is machined on the periphery of each roller, *Fig.* 3. As the bead is forced into the rotating work blank, the work material squeezes out along the mandrel. Application of a small axial force from one direction causes nearly all squeeze-out of material to occur on the opposite side of the roller.

Pressure in the region behind the roller bead is maintained by a shoulder on the roller face, *Fig.* 3. This pressure helps constrain the small volume of metal between the bead and mandrel at their

Fig. 2. Setup for rolled extrusion of thin-wall tubes.



Abstracted from paper 22T1, "Rolled Extrusion of Thin-Walled Parts," presented at the 22nd ASTE Annual Meeting. Copies of the complete paper are available from Society Headquarters.

closest point. The small volume of metal is tangentially constrained by the elastically compressed metal ahead of and behind the small volume undergoing extrusion at any one instant. These localized geometric volumes are then scanned through the work material in helical patterns resulting in the thick-walled blank being forced into a thin-walled cylinder without loss of material. A wall thickness reduction of 30:1 in a single pass through the rollers can be achieved with the Uniskan process. This order of reduction is believed possible only with extrusion of some sort, in which plastic flow is due to hydrostatic pressure set up on the unprocessed material.

After the material has been thinned, it does not transmit forces. This characteristic is in contrast to metal spinning, in which nearly all driving forces are transmitted through material that has already been thinned. Ultimate wall thinness achieved with spinning and turning methods is limited by the lack of strength of the partially thinned material. Because driving forces are carried through the thick blank in roll extrusion, it is relatively easy to obtain tubular members several inches long having wall thicknesses less than 0.001 inch.

Forming Slots in Thin Walls

One-piece structures for electron tube control grids can be made by a variation of the thin wall tubing process. Mandrels differ from those used in the previous discussion in that longitudinal grooves which determine the number, size, and shape of the grid strands, are ground on the outside diameter of the mandrel, *Fig.* 4. Material is forced into these grooves as the mandrel and work blank pass through the rollers. The formed part consists of a cylindrical array of narrow ribs connected by a foil-like web. The web is removed by dipping the part in an etching bath, which leaves an accurately formed grid structure free from stresses.

Portions of the support below, and in some cases above, the grid strands are formed into an accurate cylindrical surface by an additional step. After the desired length of grid has been formed, the rollers are backed off slightly and the axial feed continued for a short distance over an ungrooved area of the mandrel.

Design and Materials

Mandrels and rollers must be smooth and concentric to produce grid strand widths of 0.0002 inch. Satisfactory mandrels have been made of chromium alloy steel.

Rollers made of a high-carbon tool steel have been found most suitable. Diameters are one inch with a peripheral convex radius of about 0.062 inch.

Materials suitable for extrusion range from soft copper to harder materials such as molybdenum. A suitable etchant for grids made of copper is a 30 to 50-percent solution of nitric acid in distilled water. Other metals require different etchants. For example, tantalum requires hot hydrofluoric acid with a trace of nitric added.

The examples described are but a few of many possible applications of this process. Ease of fabrication, simplicity of the required tools, and the relatively small total forces involved make Uniskan extrusion useful for producing a variety of intricate and delicate parts.

Fig. 3. Detail of extrusion process.

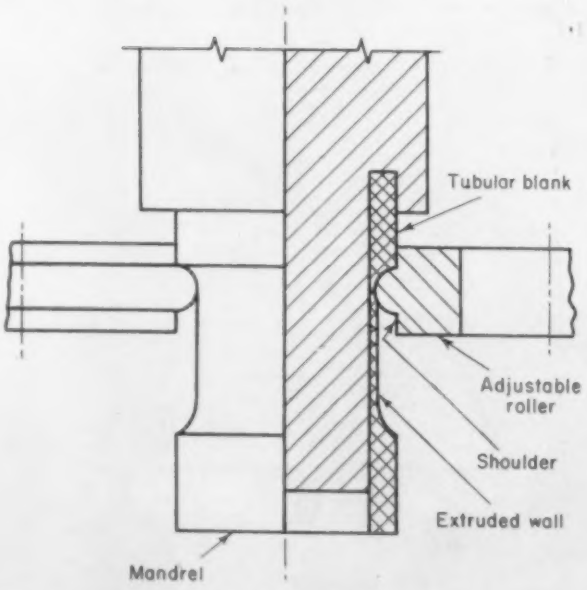
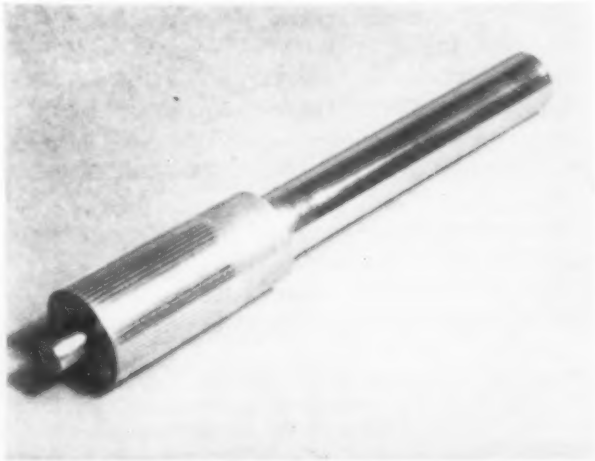


Fig. 4. Grooves ground in the polished mandrel determine the number, size and shape of the strands in a grid electrode made by Uniskan extrusion.



investment in the future:

an effective training program

By John W. Greve
Editor

ONE OF THE MOST IMPORTANT responsibilities of industry, but frequently overlooked, is the training of apprentices. Generally, small and medium-size companies have not felt equipped to develop an integrated training program, believing that larger organizations can do a better job with their extensive facilities. To some extent, this has been true and many large companies have admirable programs. But these companies, however effective their programs, could not hope to supply industry with experienced production personnel or future engineers and executives, especially in an expanding economy or in a national emergency.

Small companies have a decided advantage in developing apprentices into engineers and executives which is not shared by the larger companies. This advantage is close and personal contact with top executives. The trainee can see at close range the interrelations between the many facets of an organization. He can more readily grasp their significance and understand their importance. When the president of a company personally supervises his training program and insists that it be operated so that each apprentice actually has an opportunity to learn through actual practical experience as well as through formal classroom work, the program is bound to be successful.

Such a program is operated by the Balas Collet Manufacturing Co. in Cleveland, whose president, John Cox, has made a hobby of apprentice training. He studies each individual personally, follows his development with interest and encourages him in achievement. He watches classroom as well as shop work and frequently takes an apprentice with him on business trips. These boys are the future of



Three months of office work shows the apprentice the importance of operations such as taking customer orders and following up deliveries.

his company and no effort is spared to give them the benefit of his long experience. Also, he personaly arranges outings and social events, instilling in them the spirit of cooperation and teamwork.

Believing that too many training courses are merely methods for getting cheap labor, Mr. Cox has set up a rigorous program with training as his sole objective. His methods and philosophy are such that he instills loyalty and a sense of belonging in each trainee, an essential ingredient of investment in the future. It is his opinion that other companies lose trainees because they have not been developed as part of the organization. They should sit in on management conferences and similar meetings to develop their sense of belonging and responsibility.

The administration of an apprentice program becomes simple when the forms and methods developed by Mr. Cox are followed. The administration of his program is delegated in its entirety to Miss Hassey whose regular duties are stenographic and general office work. She estimates that the details of the program require about 2½ hours a week.

Now in its fourth year, this training course is recognized by the government and state draft board as a deferred occupation.* With a shop force of 115 men, there are at present 12 apprentices or 10 percent of the employees. Three new apprentices, not over 20 years of age, are added each year. Some are selected from the shop but the majority are recruited from the upper third of high school graduating classes. Selection is based upon personal interviews with the president.

The basic course is four years (classroom work and 8000 hours shop training) but the student can elect a nine-year course at night school study and receive a degree in mechanical engineering. Normally a good mechanic could be trained in eight to

*Deferred classification applies after 1000 hours of training, ref. Executive Order No. 10366, June 27, 1952, Selective Service Regulation, Part 1622, "Classification Rules and Principles Standards and Requirements for Apprentice Training Programs."



JOHN R. COX founded the Balas Collet Mfg. Co. in 1944. Three years ago, he initiated the training program discussed in this article. Starting in 1919 as a graduate apprentice from Warner & Swasey Co., he became superintendent of Kunkle Valve Co. at Fort Wayne and then general foreman for Foster Machine Co. at Elkhart. In 1922, he formed the Cleveland Piston Mfg. Co., which was later sold to Thompson Products, Inc., where he served as Director of Manufacturing for all the company's plants.

While at Thompson Products, Mr. Cox inaugurated an apprentice training program which is still supplying the company with trained personnel. In 1939, he went to the Weatherhead Co. in Cleveland as vice president and general manager and started another successful training program.

In addition to his regular duties, Mr. Cox has found time to do consulting work for other companies as well as the Army Ordnance. He has also served as chairman for the Society of Automotive Engineers and is a past president of the National Screw Machine Products Assn.

Drafting a practical problem in the shop gives meaning to the principles learned in the classroom.



ten years in these highly specialized operations but, with this training program, a better mechanic can be trained in four years. In addition he knows all the operations, an advantage in this highly specialized plant.

This course is modeled after successful plans that have been in operation for 16 years in larger companies where more than 70 percent of the original students now have responsible positions in executive and engineering capacities. Very few have remained as mechanics. In fact, the figure is less than 7 percent. Experience has shown that better executives can be made from these apprentices than from college graduates. This is because the man has learned by practical experience how to do things and how to get along with people. A college graduate could do the same or better, having a broader basis on which to work, if he were willing to go through the same shop training.

Because of the small number of apprentices in each class, the development of a separate text for classroom work, like in larger companies, would be impractical. For this reason, the Balas Company has tied in its course with Fenn College in Cleveland. The formal classroom work is carried on in evening classes to augment the training program. Even this system, born of necessity, has advantages over company instructors and classes in that the students are in classes with boys from other plants. This has proved stimulating and broadening for the students through the interchange of ideas and information.

Training Program: Purpose of the program is to develop a pool of experienced personnel for executive and supervisory positions in the future. Such positions include: Sales engineers, draftsmen, foremen, superintendents, toolmakers, maintenance engineers, etc. The student has the option of the four-year course which is a nondegree technical training program and the nine-year course leading to a degree in mechanical engineering. Both courses involve shop training and experience augmented by evening courses at Fenn College. For the four-year course, typical shop training includes:

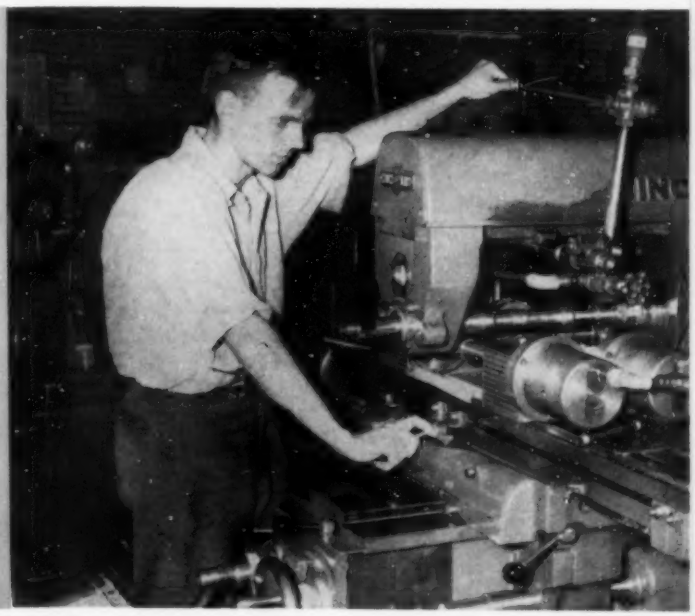
Drill press and burring	250 hours
Lathe	750 hours
Turret lathe	1,000 hours
Milling machine	500 hours
Toolroom	1,000 hours
Vertical shaper	500 hours
Thread mill	500 hours
Automatic screw machine	1,000 hours
Grinding	1,000 hours
Heat treating	500 hours
Drafting and inspection	500 hours
Miscellaneous	500 hours
	8,000 hours
Office work	3 months

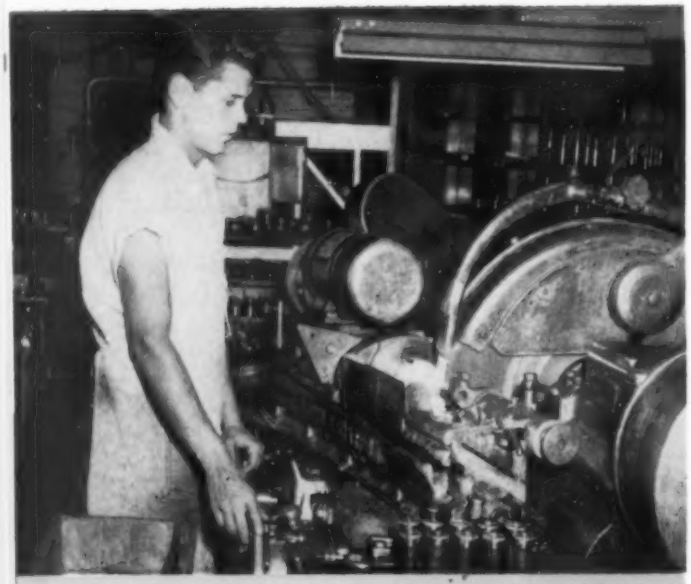
The formal classroom and laboratory work supplementing this nondegree program requires eight semesters of 16 weeks each and consists of the following subjects. The figures in parentheses indicate hours per week.

Boring with an engine lathe teaches the practical use of this basic tool.



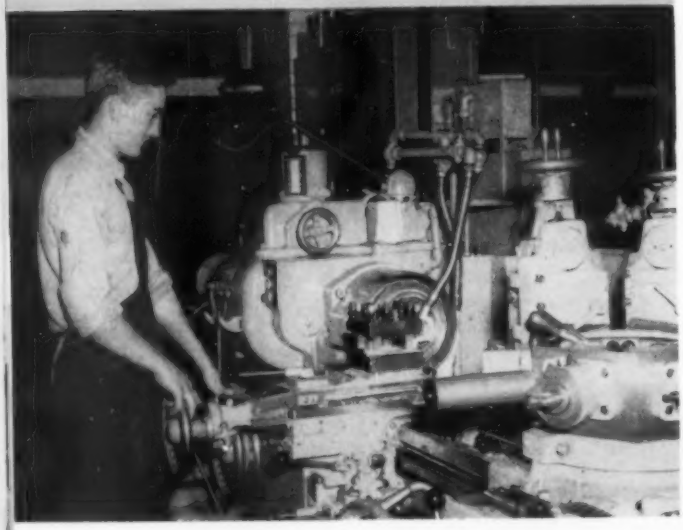
Performing slitting operations on a milling machine show production advantages of a well-tooled setup.





External grinding operations on collets quickly teach the trainee the importance of precision workmanship.

Operations on a turret lathe prove the production advantages of a multiple-tool setup.



1. Applied algebra (2)
   Technical drafting (5)
2. Trigonometry and slide rule (3)
   Technical drafting (5)
3. Elementary mechanics (2)
   Tool design I (5)
4. Strength of materials (2)
   Tool design II (5)
5. Chemistry (3)
   Tool design III (5)
6. Heat treating (5)
   Tool engineering theory (2)
7. Elements of electrical engineering (6)
8. Elements of electrical engineering (6)

Optional courses include the following electives: Tool design IV, Industrial hydraulics and Industrial safety. This nondegree course does not require exceptionally high entry standards and provides all of the essential subjects necessary to a successful mechanical career. The evening-school degree course, consisting of eighteen semesters, includes the usual studies in mechanical engineering.

To assist the students and provide additional incentives, the company pays the full tuition for all trainees averaging grades of *C* or better. It pays 75% of the tuition of students averaging *D* and none of the tuition for those failing to make passing grades.

Trainees are assigned to factory work on any of the shifts where openings appear and receive shift bonuses. They work the same number of hours as the shift and receive pay ranging from $1.10 to $1.64, graduated over the four-year period. Upon completion of the course, the trainee receives a certificate, a suitable emblem and $100 in cash. Employment at going rates of pay is offered to graduates according to their skill and ability.

Apprentices: Applicants between the ages of 17 and 20 years are selected by personal interview on the basis of good health, habits and character as well as education equivalent to graduation from an accredited high school. An applicant is subject to the rules and regulations governing all employees of the company. To judge his fitness for his chosen work, the first six months of his service is a trial term and may be terminated any time within this period if he fails to develop. To facilitate accurate and prompt appraisal, reports of the applicant's progress and general deportment are made to the management on the first day of each month (Supervisor's Report).

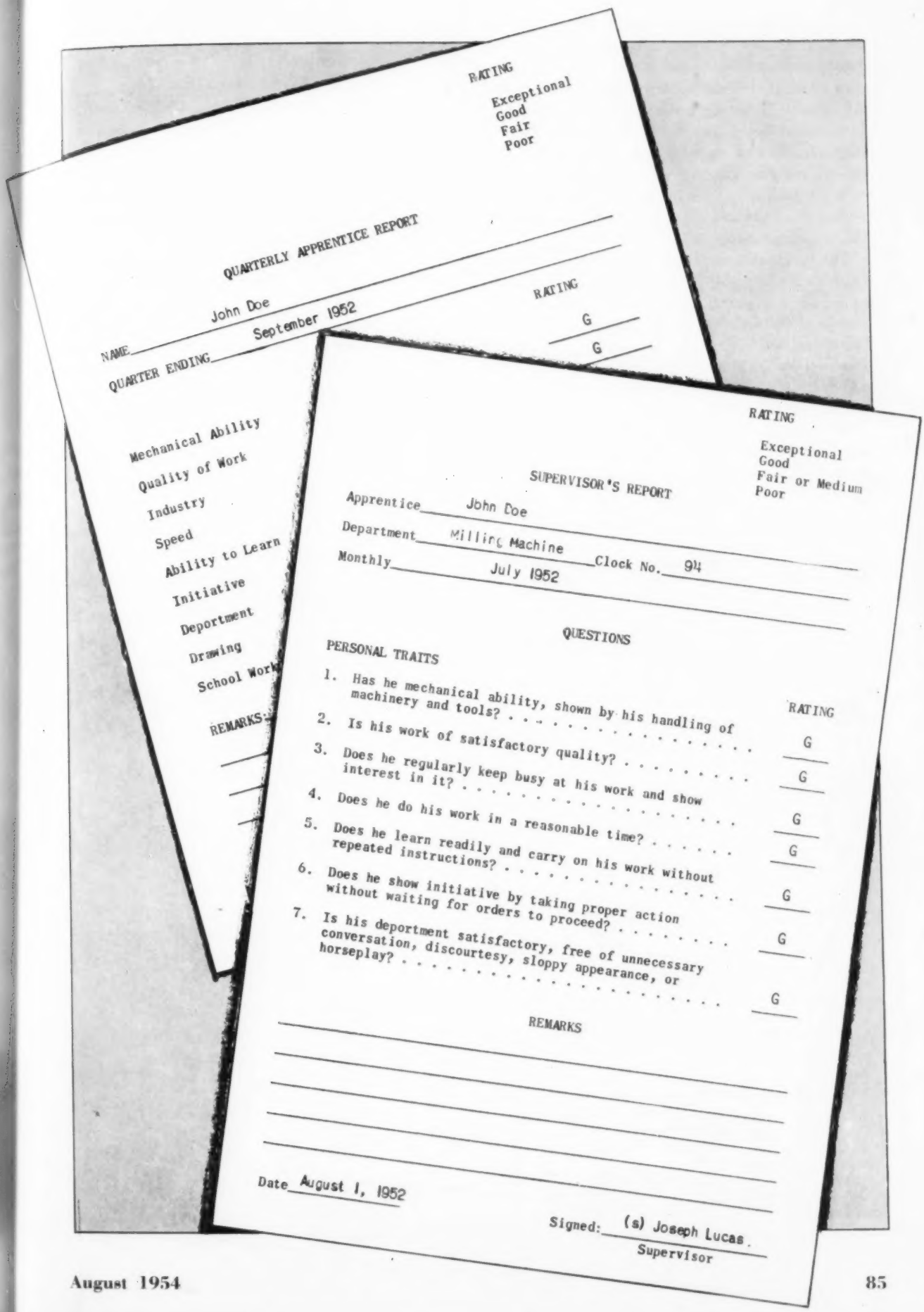
If the applicant's performance is satisfactory during this trial period, he becomes employed as a regular apprentice with his six-month trial period applying toward the time of apprenticeship. To be enrolled as an apprentice, however, the parent or guardian as well as the apprentice signs an agreement of good faith with the company for the term of apprenticeship.

During the entire training period, written reports

Opposite Page—

Quarterly reports (upper), tabulating the trainee's progress, are sent to the parent.

Monthly reports (lower) of an apprentice's progress are made to management during the trial period.



RATING

Exceptional
Good
Fair
Poor

QUARTERLY APPRENTICE REPORT

NAME John Doe

QUARTER ENDING September 1952

RATING

Mechanical Ability G
Quality of Work G
Industry
Speed
Ability to Learn
Initiative
Deportment
Drawing
School Work

REMARKS:

RATING

Exceptional
Good
Fair or Medium
Poor

SUPERVISOR'S REPORT

Apprentice John Doe

Department Milling Machine Clock No. 94

Monthly July 1952

QUESTIONS

PERSONAL TRAITS

	RATING
1. Has he mechanical ability, shown by his handling of machinery and tools?	G
2. Is his work of satisfactory quality?	G
3. Does he regularly keep busy at his work and show interest in it?	G
4. Does he do his work in a reasonable time?	G
5. Does he learn readily and carry on his work without repeated instructions?	G
6. Does he show initiative by taking proper action without waiting for orders to proceed?	G
7. Is his deportment satisfactory, free of unnecessary conversation, discourtesy, sloppy appearance, or horseplay?	G

REMARKS

Date August 1, 1952

Signed: (s) Joseph Lucas
Supervisor

of the workmanship, fitness and deportment of the apprentice, together with recommendations as to his future work are sent to the parent of the apprentice on a quarterly basis (Quarterly Apprentice Report). All reports during the training period are tabulated in summary form (Shop Work Record) so that the management can visualize the progress of each trainee and give whatever additional assistance may be warranted to help the trainee. The pattern of this record also indicates the capacity and future potentialities of the employee.

The company's responsibility to the trainee during his apprenticeship is to give him an opportunity to acquire a practical knowledge of the machinist's trade and general factory management. In return, the apprentice is expected to manifest evidence of ambition by faithful and diligent work in the shop and in his studies, thus fitting him to hold positions of usefulness and responsibility.

An apprentice agreement may be terminated at any time for any of the following reasons: Nonconformity to the rules and regulations of the company, lack of effort or capacity, failure to maintain an acceptable grade in classroom work, indifference to duties, or improper conduct.

Profit Sharing: As a full-fledged employee, the apprentice shares in the company's profit-sharing plan. This plan, which excludes the owners of the business, distributes 15 percent of the company's profit among the employees in proportion to their earnings. Overtime earnings are excluded from the calculations in distributing the profit. By being included in this plan, the apprentice quickly develops a sense of belonging and an appreciation of his responsibility in contributing to the company's welfare.

Even though the apprentice training plan has been in operation only a few years, it has already proved to be extremely worthwhile both to the apprentice in training him for his life work and to the company in assuring it of well qualified and trained individuals for its future operation and management. Any successful plan must be advantageous to both. This program is truly an investment in the future.

Summary of apprentice's achievements during training is tabulated to show his abilities and progress.



SHOP WORK RECORD

LEGEND -- RATING

Exceptional
Good
Fair
Poor

No. _____ NAME JOHN DOE

REPORT	Mechanical Ability	Quality of Work	Industry	Speed	Ability to Learn	Initiative	Deportment	Drawing	School Work	Date
Superintendent's Report	E	G	G	G	E	G	G			July 1951
" "	E	G	G	G	E	G	G			Aug. 1951
" "	E	G	G	G	E	G	G			Sept.1951
PARENT REPORT	E	G	G	G	E	G	G			Oct. 1951
Superintendent's Report	E	G	G	G	E	G+	G+			Oct. 1951
" "	E	G	E-	G	E-	G+	G+			Nov. 1951
" "	E-	G+	G	G	G	G	G			Dec. 1951
PARENT REPORT	G	G	G	G	G	G	G			Jan. 1952
PARENT REPORT	E	G	G	G	G	G	G			Apr. 1952
PARENT REPORT	G	F	G	G	G	G	G			July 1952
PARENT REPORT	G	G	G	G	G	G	G			Oct. 1952
PARENT REPORT			G	G	G	G	G			Jan. 1953
PARENT REPORT										Apr. 1953
PARENT REPORT										July 1953

Calculation of Sheet Metal Bend ALLOWANCES

By Doildeen L. Freneh*
Tool Engineer
Burlington, N.C.

WHEN BENDING SHEET METAL, the usual method of finding the developed length for a part is to calculate lengths of straight sections and add to them a bend allowance for each bend. The following short-cut method avoids computation of straight sections and increases speed of calculation when all bends are 90 deg. This method requires less computation and lessens the chance for calculation errors. Bend allowances tabulated in *Machinery's Handbook* (14th Edition) are used.

The developed length of a part is equal to the sum of the over-all dimensions of the part less a constant (K) for each 90-deg bend. For the part in *Fig.* 1, the developed length equals:

$$A + B + C + D + E - 4K$$
$$K = 2R + 2T - L$$

where

K = A constant
R = Inside radius of bend, inches
T = Material thickness, inches
L = Bend allowance, inches

Bend allowances are different for materials of different hardness. Materials are grouped as shown in the headings for TABLES 1 through 3. Formulas for bend allowances for the three hardness classifications are:

$$L_1 = 0.55T + 1.57R$$
$$L_2 = 0.64T + 1.57R$$
$$L_3 = 0.71T + 1.57R$$

The various values for constant K are tabulated in TABLES 1 through 3 for various metal conditions, thicknesses and radii.

A simple example will illustrate the method by which developed lengths are calculated. Desiring to make the common chassis shape shown in *Fig.* 2, what is the developed length of the aluminum blank that should be used? The developed length is equal to the sum of the over-all dimensions ($0.75 + 10.5 + 0.75 = 12.00$) less a constant for each of the bends ($K = 0.133$ from TABLE 1), or 11.734 inches.

When constants are not included in the tables for a specific set of conditions, they can be easily calculated from the following formulas:

$K_x - K = 1.45\ (T_x - T)$ ..... TABLE 1 materials
$K_x - K = 1.36\ (T_x - T)$ ..... TABLE 2 materials
$K_x - K = 1.29\ (T_x - T)$ ..... TABLE 3 materials

Fig. 1. Typical part to be formed with 90-deg. bends.

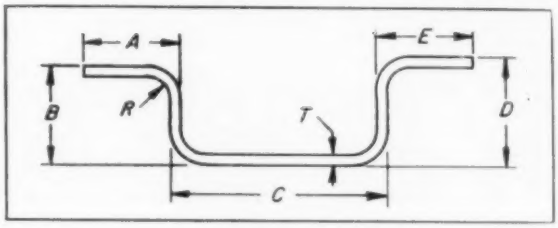
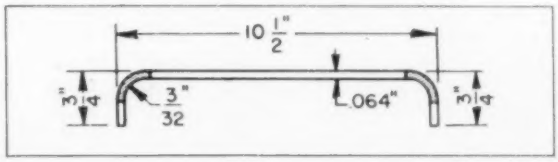


Fig. 2. Example of method for determining developed length by short-cut method.



*Junior member ASTE Piedmont chapter.

where

K_x = Unknown constant for thickness T_x and radius R

K = Known constant for thickness T and radius R

If a new material thickness, 0.002 inch thicker than one shown in TABLE 1 for a particular radius, is to be bent, the desired constant would be 1.45 x 0.002, or 0.0029 greater than the value listed.

When it is desired to determine a new constant or check a previously computed constant, the following formulas can be used:

$K_1 - K_2 = 0.09T$

$K_2 - K_3 = 0.07T$

$K_1 - K_3 = 0.16T$

where numerical subscripts indicate the materials involved as listed in the table with the corresponding number.

If an aluminum part, 0.064 inch thick with radii of $\frac{3}{32}$ inch and K of 0.133, is being bent, determine the K if the part were changed to half-hard brass.

$K_1 - K_2 = 0.09T$

$0.133 - K_2 = 0.09\ (0.064)$

$K_2 = 0.133 - 0.00576$

$K_2 = 0.1274$

With this method and these formulas, determination of developed lengths for parts with 90-deg bends is greatly simplified.

Table 1—Constant *K* for Magnesium, Aluminum, Soft Copper and Soft Brass

Radius (inch)	Thickness (Inch)										
	1/32	0.031	0.032	0.050	0.062	0.064	0.081	0.090	0.091	0.093	0.125
1/32	0.0590	0.0584	0.0598	———	0.1033	0.1062	0.1309	0.1440	0.1454	———	0.1945
3/64	0.0655	0.0651	0.0666	———	0.1101	0.1130	0.1376	0.1506	0.1521	———	0.2008
1/16	0.0725	0.0718	0.0733	———	0.1168	0.1197	0.1443	0.1574	0.1588	———	0.2080
3/32	0.0860	0.0853	0.0867	———	0.1302	0.1331	0.1578	0.1708	0.1723	———	0.2215
1/8	0.0995	0.0987	0.1002	———	0.1437	0.1466	0.1712	0.1843	0.1857	———	0.2350
3/16	0.1265	0.1256	0.1270	———	0.1705	0.1734	0.1981	0.2111	0.2126	0.2155	0.2620
1/4	0.1526	0.1522	0.1537	———	0.1972	0.2001	0.2247	0.2378	0.2392	———	0.2890

Table 2—Constant *K* for Half-Hard Brass and Sheet Copper, and Soft Steel

Radius (inch)	Thickness (Inch)										
	1/32	0.031	0.032	0.050	0.062	0.064	1/16	0.081	0.090	0.091	0.125
1/32	0.0559	0.0556	0.0569	0.0814	0.0977	0.1004	0.0984	0.1236	0.1358	0.1372	0.1834
3/64	0.0627	0.0624	0.0637	0.0882	0.1045	0.1072	0.1052	0.1304	0.1426	0.1440	0.1902
1/16	0.0694	0.0691	0.0704	0.0949	0.1112	0.1139	0.1119	0.1371	0.1493	0.1507	0.1969
3/32	0.0828	0.0825	0.0838	0.1083	0.1246	0.1273	0.1253	0.1505	0.1627	0.1641	0.2103
1/8	0.0962	0.0959	0.0972	0.1217	0.1380	0.1407	0.1387	0.1639	0.1761	0.1775	0.2237
3/16	0.1231	0.1228	0.1241	0.1486	0.1649	0.1676	0.1656	0.1908	0.2030	0.2044	0.2506
1/4	0.1500	0.1497	0.1510	0.1755	0.1918	0.1945	0.1925	0.2177	0.2299	0.2313	0.2775

Table 3—Constant *K* for Hard Copper, Bronze and Brass, and Cold Rolled, Spring and Stainless Steel

Radius (Inch)	Thickness (Inch)											
	1/32	0.031	0.032	0.050	0.062	1/16	0.064	0.080	0.081	0.090	0.091	0.125
1/32	0.0538	0.0535	0.0548	0.0780	0.0935	0.0941	0.0960	0.1168	0.1181	0.1296	0.1309	0.1747
3/64	0.0603	0.0602	0.0615	0.0847	0.1002	0.1008	0.1027	0.1235	0.1248	0.1363	0.1376	0.1814
1/16	0.0672	0.0669	0.0682	0.0914	0.1069	0.1075	0.1094	0.1302	0.1315	0.1430	0.1443	0.1881
3/32	0.0806	0.0803	0.0816	0.1048	0.1203	0.1209	0.1228	0.1436	0.1449	0.1564	0.1577	0.2015
1/8	0.0941	0.0938	0.0951	0.1183	0.1338	0.1344	0.1363	0.1571	0.1584	0.1699	0.1712	0.2150
3/16	0.1209	0.1206	0.1219	0.1451	0.1606	0.1612	0.1631	0.1839	0.1852	0.1967	0.1980	0.2418
1/4	0.1478	0.1475	0.1488	0.1720	0.1875	0.1881	0.1900	0.2109	0.2121	0.2236	0.2249	0.2687

ASTE News



ASTE national officers for 1954-55 hold their first meeting at Society headquarters in Detroit. Clockwise are: Fay H. LaRoue; H. Dale Long, assistant secretary-treasurer; R. C. W. Peterson, treasurer; Dr. Harry B. Osborn, Jr., first vice president; Harry E. Conrad, executive secretary; Joseph P. Crosby, president; Wayne Ewing, secretary; Howard C. McMillen, third vice president; Allan Ray Putnam, assistant executive secretary; H. E. Collins, third vice president; and Sylvia Benesh.

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BOSTON chapter of ASTE was the first society to make a financial contribution to the city's new educational television station. Scheduled to go into operation this fall, the station will be telecasting only education programs. ASTE members in the area hope to sponsor a show on tool engineering and activities of the Society.

HELP from the Toronto ASTE chapter for Canada's program of rehabilitation of prison inmates has been gratefully acknowledged by the country's assistant commissioner of penetentiaries, J. A. McLaughlin.

A copy of the *Tool Engineers Handbook* was donated by the chapter to be used as an award to the outstanding participant in the vocational training program of one of the larger penetentiaries.

In his letter of appreciation, Mr. McLaughlin reported that the motivation and incentive aroused by the award was remarkable. He voiced the hope that other organizations would follow the "outstanding example set by the Toronto ASTE chapter in providing tangible proof of their interest in the rehabilitation program".

ANOTHER handbook in the news is the one given to the Erie Public Library by the ASTE chapter in Erie, Pa. It was presented by education chairman Harold W. Hagle to Dr. John Hickey, superintendent of schools, and put on display at the library during the week of May 17 to be viewed by the public.

IT LOOKS like a banner year coming up for ASTE on-campus conferences. Calendars for 1954-55 list more of these educational programs than have been scheduled in any previous year.

Already slated for next fall are meetings at the University of Iowa, University of Michigan, Lehigh University, and one at Chicago sponsored jointly by the University of Illinois, Illinois Institute of Technology, Northwestern University and the Illinois chapters of ASTE. Conferences may also be held at San Jose State College and at the University of Wisconsin.

Spring of 1955 will see meetings at Michigan State College, Purdue University and Pennsylvania State College, with others tentatively scheduled for University of Houston and Ohio State University.

ASTE Research Fund Sponsors First Project

The Research Fund Committee of the American Society of Tool Engineers has recently let its first research contract. Solidifying the position of ASTE as a leader in the field of tool engineering, this contract was placed with Columbia University for a study into the distribution of heat generated during the cutting of metal. This investigation shows promise of leading to practical results that can be immediately applied. It will attempt to fill in some of the blanks in metal-cutting technology and lead to more realistic specification of tool forms, cutting angles, and speed, feed and depth of cuts.

The Columbia heat and mass flow analyzer (an analogue computer) will be applied during this investigation because of the ease with which the effects of individual variables can be studied. Use of the analyzer was suggested by its successful application in determining core temperatures during casting and plotting heat flow during quenching.

The present investigation will comprise several phases. The first step will consist of computing temperatures in a theoretical workpiece under various cutting conditions. Results of these computations will be evaluated to determine which of the many cutting variables are main contributors to the final temperature pattern. The final step will be an attempt to actually measure temperatures under conditions identical with the hypothetical setup. This work will probably require special measuring techniques in view of the rapid changes in temperature that will be encountered.

Computations and evaluation will be under the direct supervision of Dr. Victor Paschkis, Technical Director, Heat and Mass Flow Laboratory, Columbia University, who originally proposed the research project. Actual temperature measurements will be under the direct supervision of Profs. Englund and Baker of the Columbia Department of Mechanical Engineering.

A Steering Committee has been appointed to assist Col. L. S. Fletcher, research director for the ASTE Research Fund Committee, in the supervision and final evaluation of the project. Committee members are: Dr. George A. Roberts, vice president in charge of technology, Vanadium Alloys Steel Co.; Dr. W. E. Mahin, technical director, Vanadium Corporation of America, and a member of the ASTE Research Fund Committee; Dr. A. O. Schmidt, research engineer, Kearney & Trecker Corp.; and D. N. Smith, manager of the Research Division, Jones & Lamson Machine Co.

Work is expected to start in the near future at Columbia University, a co-sponsor who will share in the cost of the project.

Illinois On-Campus Conference

Sponsored for all ASTE chapters in the state, the Illinois On-Campus Conference moves this year from the University of Illinois campus at Urbana to Chicago where a two-day program has been planned for Friday and Saturday, October 8 and 9.

Sessions of the fourth annual conference will be held at the Navy Pier branch of the University of Illinois, Illinois Institute of Technology, and Northwestern University. The final event on the program is a dinner meeting to be held at the Sheraton Hotel. A complete schedule of ladies' activities has also been arranged for the conference.

Technical meetings will offer discussions on machining with carbides, and tool materials to meet increasing machining rates. Panels will cover cost reduction and tools for cost reduction; machine tool design with emphasis on gears, hydraulics and electronics; and jigs, fixtures and gages.

Tours are scheduled for Navy Pier, Illinois Institute of Technology engineering laboratories and the Armour Research Foundation, and the engineering facilities at Northwestern University.

Chartering of three chapters in June by the American Society of Tool Engineers increased the Society's total number of chapters in the United States and Canada to 118. The new chapters receiving charters are Kalamazoo and Battle Creek, Michigan, and Southeastern Massachusetts. These groups added approximately 335 new members to the ASTE roster.

News Editor
By Nancy L. Morgan

KALAMAZOO

Harry B. Osborn, Jr., first vice president and a national director of the Society, presented the Kalamazoo charter at ceremonies held on June 8 at the Harris Hotel.

Guest speaker for the evening program was Frank C. Hockema, vice president and executive dean of Purdue University, Lafayette, Ind. A favorite ASTE personality, he talked on the topic "Who's Who in Kalamazoo."

Members and guests of ASTE's 116th chapter also heard Allan Ray Putnam, assistant executive secretary, who acted as toastmaster; Ervin Byro, area captain of the National Membership Committee; and Marvin J. Bunting, secretary of the National Membership Committee.

Kalamazoo chapter officers are: chairman—C. A. Elzinga, general manager, Industrial Sales & Engineering Co.; first vice chairman—Lionel J. Anderson, designer, Professional Design Service; second vice chairman—Maynard L. Foskett, assistant to the president, Clarage Fan Co.; secretary—Robert Frye, manager, General Tool Co.; and treasurer—William G. Saville, tool engineer, Atlas Press Co.



Well-known to ASTE audiences, Dean Frank C. Hockema of Purdue University was the featured speaker.



Chairman C. A. Elzinga, holding charter, and the other members of the newly-installed officer group. From left: Robert Frye, secretary; Lionel J. Anderson, first vice chairman; Maynard L. Foskett, second vice chairman; and William G. Saville, treasurer. The Kalamazoo charter was the 116th awarded by ASTE.



Dr. Harry Osborn, second from left, presents the charter to Battle Creek Chairman Koons. Watching, from left, are: W. W. Reed, second vice chairman; R. H. Lawrence, treasurer; H. G. Martin, secretary; and H. P. Garms, first vice chairman.

BATTLE CREEK

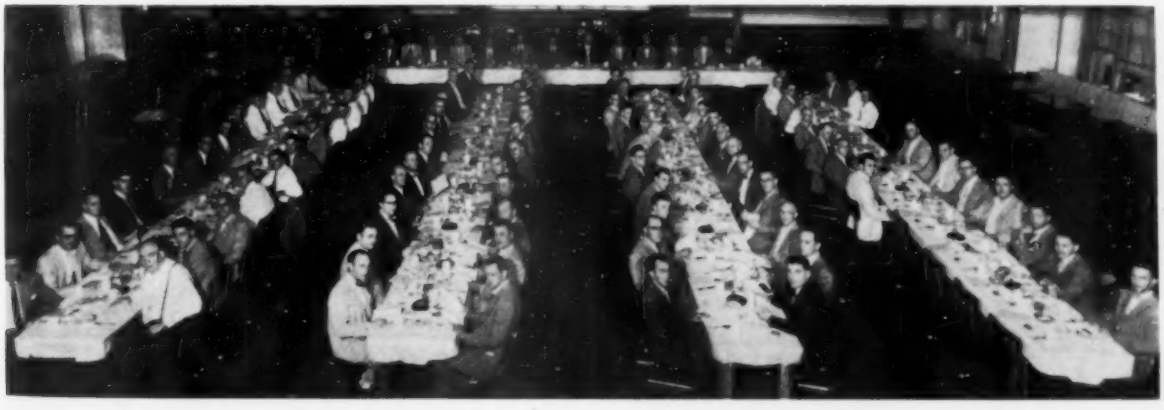
Just 70 days after the first organizational meeting, Battle Creek members received their ASTE charter on June 9 and became the Society's 117th chapter.

Heading the group is Clarence F. B. Koons, process engineer for The Oliver Corp. Other officers are: first vice chairman—H. Palmer Garms, methods superintendent, The Oliver Corp.; second vice chairman—Warren W. Reed, tool engineer, Clark Equipment Co.; secretary—Henry G. Martin, assistant to chief tool designer, The Oliver Corp.; and treasurer—Richard H. Lawrence, tool supervisor, E. W. Bliss Co.

All were sworn into office by Harry B. Osborn, Jr., ASTE first vice president and national director. Dr. Osborn also presented the charter.

Program speaker was Frank C. Hockema, vice president and executive dean of Purdue University. He was introduced by Allan Ray Putnam, ASTE assistant executive secretary. Other guests at the meeting, held at the Elks' Temple, included Thomas E. Barber, chairman of the National Program Committee; Prof. Orville Lascoe, member of the National Education Committee; Ervin Byro, area captain for the National Membership Committee; and Marvin J. Bunting, secretary of the National Membership Committee.

The auditorium of the Elks' Temple was the setting for Battle Creek's charter night activities.





The most novel presentation of the evening was the baby bottle given to Chairman Somers by Allan Ray Putnam, assistant executive secretary, in honor of the chapter's position as the youngest in ASTE.



Joseph R. Crosby, left, national president of the Society, was the chartering officer for the Southeastern Massachusetts chapter. John Somers, newly-installed chairman, receives his congratulations.

SOUTHEASTERN MASSACHUSETTS



Chapter officers, from left, are: E. J. Boudreau, treasurer; R. E. Holbrook, first vice chairman; J. H. Somers, chairman; R. E. Manchester, second vice chairman; and John Cieplik, secretary.

Vic Ericson was the toastmaster for the program.



ASTE's 118th chapter—Southeastern Massachusetts—was officially added to the Society roster on June 22. Chartering ceremonies were held at Gaudette's Pavilion at Acushnet, with National President Joseph P. Crosby officiating.

Chapter officers are: chairman—John H. Somers, engineer for Laird De Vou, Inc.; first vice-chairman—Raymond E. Holbrook, chief tool engineer for Metals & Controls Corp.; second vice chairman—Ralph E. Manchester, owner of Industrial Engineering Service; secretary—John Cieplik, service engineer for HyPro Tool Co.; and treasurer—Edward J. Boudreau, president of New England Die, Inc.

Toastmaster for the event was Victor H. Ericson, past national director and a former treasurer of ASTE. He introduced all of the speakers, including Director Richard Smith who presented the chairman's pin; and Membership Committee Secretary Marvin J. Bunting who presented the membership kit.

Among the guests seated at the head table were: John X. Ryneska, chairman of the National Constitution and By-Laws Committee; Robert Gay, chairman of the Hartford chapter; Karl G. Nowak, chairman of the Boston chapter; William T. Nystrom, chairman of the Little Rhody chapter; Cyril K. Brennan, mayor of Attleboro; C. Gerald Lucey, mayor of Brockton; and Arthur N. Harriman, mayor of New Bedford.

National Committee Chairmen Announce 1954-55 Appointments

By Edith R. Saunders
Assistant News Editor

National committee chairmen have appointed the men who will serve with them in ASTE's various fields of endeavor for the 1954-55 term.

The ASTE Book Committee, again headed by Francis J. Sehn, will include Norman L. Kenerson of Detroit; Maurice M. Clemons of Cleveland; Glenn A. Hier of Cleveland; Philip C. Wood of Toledo; Willis J. Potthoff of St. Louis; Edward A. Reed of Saginaw Valley; Ralph F. Weil of Pontiac; Ray J. Wilcox, member at large; Frank Wilson, technical director of ASTE; and John Holt, Jr., editor.

Society Procedures

Rules, regulations and procedures will be chief concern of the National Constitution and By-Laws Committee under the direction of Chairman John X. Ryneska. Serving under Mr. Ryneska will be: Ray H. Morris of Hartford; C. Russell Miller of Dayton; and Vincent M. Spahr of Lima.

The National Editorial Committee under the chairmanship of Joseph L. Petz will incline their efforts toward bringing the ASTE members an even better publication of THE TOOL ENGINEER. The Committee will consist of Gustave B. Berlien of Golden Gate; Lee M. Davis of Twin States; David A. Schrom of Central Pennsylvania; Charles H. Thuman of Evansville; George P. Torrence of Rockford; and Donald E. Wernz of Baltimore.

Wider dissemination of the knowledge of tool engineering will be the goal of the National Education Committee and its new head, Prof. Robert E. McKee. Committee members will be: Myron L. Begeman of Houston; Charles C. Lasater of Knoxville-Oakridge; Orville D. Lascoe of Indianapolis; Cyril R. Mitchell of Niagara District; Richard B. Niebusch of Cincinnati; Frederick Preator of Salt Lake City; and Carl J. Oxford, Jr., of Detroit.

ASTE's money matters are in the hands of the National Finance Committee directed by newly-appointed Fred Kampmeier. Serving with Mr. Kampmeier are: Frederick Anderson of Hartford; Duane H. Brighton of Peoria; Frank J. Hausfeld, Jr., of Evansville; R. C. W. Peterson of Toledo; and Henry A. Rockwell of Hartford.

The National Honor Awards Committee, led by T. Bert Carpenter, will be comprised of D. D. Burnside of Cleveland; Frank W. Curtis of Detroit; A. H. d'Arcambal of Hartford; Ray H. Morris of Hartford; James R. Weaver of Springfield, Mass.; Otto W. Winter of Buffalo-Niagara Frontier; Frank A. Shuler of Detroit; and Walter F. Wagner of Detroit.

The National Judicial Committee, headed by W. H. Smila, will consist of Awards Committee Members Frank W. Curtis; A. H. d'Arcambal; Ray H. Morris; James R. Weaver; Otto W. Winter; Frank A. Shuler; Walter F. Wagner; and T. Bert Carpenter.

Largest Committee

ASTE's largest committee, the National Membership Committee, will be headed this year by William W. Schug. Members of his committee include: Irving H. Buck of North Texas; Ervin A. Byro of Muskegon; Lawrence H. Cook of Santa Clara Valley; Douglas R. Cooper of Toronto; Frank A. Flannery of Akron; Carl J. Hoffman of Syracuse; Carl Kertesz of Greater New York; H. Verne Loeppert of Chicago; Emanuel E. Lull of New Haven; Errol H. Porter of Indianapolis; Louis Slager of St. Louis; Alfred E. Beaumont of Los Angeles; and Gordon W. Carlton of Cleveland.

Other members of the committee are: George W. Christiansen of Racine; Frederick J. Crook of Toronto, Edwin C. Bates of Elmira; William H. Gourlie of Hartford; Sam L. Grasso of Nebraska; C. J. Helton of Denver; C. J. McDowell of Montreal; A. F. Moosbrugger of Piedmont; Harry E. O'Hara of Memphis; Gerald E. Osworth of Waterloo Area; James C. Rodgers of Baltimore; Orville B. Strahm of Wichita; Glen H. Stimson of Northern Massachusetts; Samuel R. Boyer of Philadelphia; Thomas C. Bradford of Worcester; Robert W. Miller of Piedmont; and Edward H. Wells of Piedmont.

Prof Larry E. Doyle, chairman of the National Professional Engineering Committee will be aided by members: Hugo L. Aglietti of Long Island; Jimmie E. Franklin of North Texas; V. H. Gallichotte of Golden Gate; Howard W. Gross of Philadelphia; Edward C. Helmke of Madison; George Julien of Twin States; John Lengbridge of Toronto; Leslie C. Seager of Salt Lake City; and C. M. Smillie of Detroit.

The National Program Committee's new chairman is Thomas C. Barber. He will carry out his activities with the help of Ralph Chrissie of Los Angeles; Edward Neal Dietler of Piedmont; Philip R. Marsilius of Fairfield County; Frank Martindell of Chicago; Kenneth W. Riddle of Philadelphia; and Harmon O. Traughber of Houston.

The program of the National Public Relations Committee under the chairmanship of Edward H. Ruder will be carried out by R. Eric Crawford of Toronto; Charles O. Herb of Northern New Jersey; Horace E. Linsley of Northern New Jersey; Wilfred B. Wells of Boston; and William Schleicher of Chicago.

Standards

George F. Bryan, heading up the National Standards Committee will be assisted by: Clyde L. Fanning of Saginaw Valley; Louis Jensen of London-St. Thomas; Harry J. Moffatt of Louis Joliet; William Moreland of Rockford; Joe Penn of Indianapolis; R. C. W. Peterson of Toledo; John E. Rotchford of Worcester; and Denis L. Swan of Windsor.

Outings Dominate Chapter Calendars

Picnics, golf parties and outings are summer traditions for ASTE chapters. Some are held 'for members only' while others are open to friends and families. But regardless of the format for these events, their objectives are the same . . . forget the more serious ASTE activities and have a wonderful time!

Camp Cleveland on Pigeon Lake was the destination for Peterboro ASTE members who set out on June 19 for the chapter's annual staf and field day. Activities at the event included softball, horseshoe pitching, a nail driving contest and a bait casting contest. Prizes went to A. Pilley, A. Griffin, Ed Roberts and his four-man team, and W. L. Jones. Turkey dinner made up the day's menu. —*Don Moorby*

Worcester chapter's annual outing at Franklin Country Club on June 19 was under the direction of Program Chairman J. Irving England and George L. Gersham, chairman of the entertainment committee.

Golfing and competitive sporting events were held throughout the day and a smorgasbord dinner whetted healthy appetites. —*John C. Lalor*

Fine weather, an afternoon of golfing, and a buffet style supper brought out 127 members and guests to the annual outing of the Milwaukee chapter on June 11. The event, including card games and 45 prizes, was held at the Tuckaway Country Club in Milwaukee.
—*Walter Behrend*

On Saturday, June 13, the New Haven chapter held its annual outing at Frank Gilbert's summer estate. Approximately fifty people played golf, soft ball, volleyball, horseshoes and quoits. Hamburgs and hot dogs stemmed the tide of tremendous appetites.

Prizes were awarded to the winning soft ball and volleyball teams and also to the champions of horseshoes and quoits by the executive committee. More adventurous members of the group were led by Mr. Gilbert in exploring an old mine shaft on his property.
—*Silas W. Becroft*

In spite of being in competition with the June 17 Marciano-Charles fight, the annual Dayton picnic and golf party was the biggest in chapter history with 140 members and guests attending. Activities took place at the Walnut Grove Country Club and "tee time" was at noon. Dinner was served at 7 p.m. and the winners of the various golf prizes were awarded. Entertainment Chairman Francis Heberling and his hard-working committee were responsible for the success of the day.
—*William J. Killinger*

ASTE members of the Portland, Me., chapter traveled to Stickney Lodge at Goodwin's Mills for their annual outing on June 19. Softball, table tennis, horseshoe pitching and fly fishing were the sports for the day. Clams and lobsters were served for dinner.
—*Henry C. Hagman*

Muncie Members Visit Fort Wayne Company

Salisbury Axle plant at Fort Wayne was visited June 4 by the Muncie chapter. Nearly 95 members and guests participated in the tour. They observed the ingenious and efficient tooling used in processing and assembling the components of rear end assemblies for several of today's automobile manufacturers. Dinner was served to the group at the plant cafeteria. —*Darrell Marks*

Diesel Engines Topic at Fort Wayne Meeting



Speaker J. W. Rowell, center, is pictured with Josef A. Deck, left, second vice chairman, and C. A. Haugh, chairman.

The most recent meeting of Fort Wayne chapter featured a talk by J. W. Rowell, supervisor of technical sales data at Cummins Engineering Co., Columbus, Indiana. He chose as his subject "Recent Diesel Engine Developments" and showed a film on "The Diesel Race Car" entered in the Indianapolis Memorial Day race.
—*R. H. Bienz*

Four Hundred Attend St. Louis Ladies Night

The Hotel DeSoto Ballroom was the scene of St. Louis' annual ladies night dinner meeting when a gratifying attendance of 400 was reported by the chapter.

Highlights of the program included an entertaining talk by one of the foremost authorities on general semantics, Dr. John J. Kessler. All past chairmen of the chapter were awarded souvenir gavels on the occasion.
—*E. Graser, Jr.*

Stanley Rimmer Speaks at Baltimore Meeting

The May meeting of the Baltimore chapter, held at the Engineers' Club, was attended by 72 members and guests.

Main speaker on the program was Stanley M. Rimmer, assistant chief product engineer at Wallace Burnes Co., Bristol, Conn. His topic was "Problems of Design and Manufacturing of Mechanical Springs."

Coffee speaker was Dr. George W. McLaren, director of athletics for the Glenn L. Martin Co. and former all-American fullback. —*Neil Heller*

Lehigh Valley Party Draws Fifty Couples

The Hotel Traylor in Allentown, Pa., was the scene of merrymaking on June 18 when Lehigh Valley chapter held its annual ladies night. Fifty couples attended. The party was launched with a reception and dinner, followed by entertainment and dancing and the ladies were presented with corsages. Arrangements were in the hands of George Savitz, chairman of the program committee.
—*Paul W. E. Gehris*

Calumet Area Holds First Ladies Program

Vogel's Restaurant on June 16 was the scene of Calumet Area chapter's first ladies night. The speaker was Bernard Better, director of research at Scully-Jones Co., Chicago.

A colored film entitled "Man With A Thousand Hands" and narrated by Raymond Massey was shown. It concerned the project in British Columbia, the construction of the Kenny Dam which is a source of electrical power to the Aluminum Co. of America. The film was produced by International Harvester Co. Some 65 attended the meeting. —*L. W. Montgomery*



Western Industrial Exposition

It has taken a long time for the dream of an ASTE Western Industrial Exposition to become a reality. Slated to be held next year in the Los Angeles Shrine Auditorium from March 14-18, this regional show climaxes years of concentrated effort by Society members who haven't had opportunity to participate in an ASTE-sponsored exposition.

Pressure for such a show has been building up during the rapid growth of western industry. In the five years between 1947 and 1952 (last available census figures), the annual output of products of western companies served by the Society more than doubled.

Similarly, in the five years between 1949 and 1954, the number of Society chapters west of the Mississippi practically doubled, with western membership jumping 143 percent. In the state of California alone, membership tripled during that same period.

As industry and ASTE membership in the West grew, demands on the Society to schedule an exposition on the West Coast increased steadily. Although industrial expositions of various types have been held on the West Coast, western industry and ASTE membership alike insisted there was no substitute for the type of expositions conducted by the American Society of Tool Engineers.

And so two years ago at a meeting of the board of directors, the proposal to hold the Western Industrial Exposition on a regional basis received final approval and the Society began plans for sponsoring a complete technical program on production problems tailored to West Coast needs.

The Shrine Auditorium was selected as the site. It provides approximately 80,000 square feet of space for exhibitors to show the latest tools, tooling, attachments, processes and accessories.

Even before the 1954 Philadelphia Industrial Exposition opened, "letters of intent to exhibit" in the Western Exposition were received by the Society. These letters have been pouring in ever since, and all indications are that the Western Industrial Exposition will be a sell-out.

Floor plans of the Shrine Auditorium have already been distributed to all firms which have shown their interest in the exposition. Allocation of exhibit space will begin sometime in early autumn and should be completed before the first of 1955.

Coverage of all developments concerned with the Western Exposition, as well as programs planned for the annual meeting being held at the same time, will be carried in these pages of THE TOOL ENGINEER.



SANTA CLARA VALLEY PROGRAM—Dr. L. H. Cook, far left at speakers table, was the technical speaker at the June 15 meeting held at Mariani's Restaurant, substituting for Ben Berlein who was called to New York unexpectedly. Shown with Dr. Cook, from left: Jack McCarthy, chairman; Frank Cavenagh, second vice chairman; Frank Menard, first vice chairman; Bill Wright, secretary; John Groves; Rudy Komuchar and Bill Forbes.—*Bud Weaver*

Students Host to Des Moines Chapter

Students of Iowa State College were hosts for the May meeting of the Des Moines chapter, which was held on the campus at Ames, Iowa.

H. Dale Long, a national director of ASTE and president of Scully-Jones and Co., Chicago, and Bernard Better, Scully-Jones research director, were introduced to the large group of students and members attending the dinner and meeting that followed.

The program on "Production Tool Development" was presented by Mr. Better who has developed a number of production tools which have been adopted as standard by metalworking industries.

As an example of the importance of tool research and development, he gave a review of how Scully-Jones and Co. successfully carried out the planning and development of a new Safe Torque Tapping Head recently put out on the market. —*J. J. Schlesselman*

South Bend Chapter Hears Chap Spencer

Chap Spencer of the Evinrude Outboard Motor Co., Milwaukee, was the guest speaker at the South Bend May 18 chapter meeting held at the Shrine Club. He discussed the development of the quiet outboard motor with particular emphasis on the most recent development of silencers for the air intake on the carburator.

A movie entitled "Trout Ala Shoshone" was shown which featured a fishing trip to Lake Shoshone in Wyoming. —*David Herring*

K. R. Blake Speaks at Wichita Meeting

Approximately 75 attended the meeting of the Wichita chapter on June 2 at the Polar Bear Club. Special guest speaker was K. R. Blake, vice president and consulting physicist of the Metalloid Corp. of Huntington, Indiana.

"Dynatomics, a New Concept in Metal Removal and Forming" was his topic. He outlined considerations of energy in the atomic lattice, thermal energy phenomena in heat treatment, cutting areas and velocities, effect of tool shape, failure in tool materials and effect of preparation and cutting fluids on machineability and tool life.

—*John G. Temple*



TOLEDO SPEAKER—Bernard R. Kesting, chairman of the Ohio State Board of Registration for Professional Engineers, addressed the May 12 meeting, held at the Maumee River Yacht Club. He said that tool engineering in Ohio is not recognized by examinations within its field of specialization because no Ohio college offers a degree in tool engineering.—*Carl W. Hoglund*

Clarence W. Hamilton of Sheffield Corp. Dies

Clarence Worthington Hamilton, 62, public relations director and administrative staff member at Sheffield Corporation, died on June 7 in St. Joseph's General Hospital, Little Current, Ontario.

Mr. Hamilton, a native of Franklin, Ohio, had left with his wife on a business trip to Canada when he suffered a heart attack soon after their arrival.

He joined Sheffield 11 years ago, leaving a post as public relations director for the Globe-Wernicke Co. in Cincinnati. Before that he had worked with the late John H. Patterson, founder of the National Cash Register Co. in Dayton. For a time he was associated with the Firestone Rubber Co.

In 1952, Mr. Hamilton was given life membership in the American Ordnance Association. At the time of the membership award, Louis Polk, president of Sheffield, cited Mr. Hamilton for his ability to "get things done, to button things up." Mr. Hamilton was also a member of the Cuvier Press Club of Cincinnati and the Dayton Press Club.

Ford Representative Speaks at Waterloo

Nevin L. Bean, technical assistant to the general manager of Ford Motor's Automatic Transmission Div., Livonia, Mich., was the guest speaker at Waterloo Area's May 19 chapter meeting. Some 150 attended the lecture on "Automation" at the Rackham Amphitheater on the University of Michigan campus at Ann Arbor.

On June 12 Waterloo Area's golf outing was held at the Plymouth Country Club, Plymouth, Mich. Approximately 105 turned out for the day's activities.

—*Ed Collins*

Evansville Members Tour Steel Plant

A group numbering 250 from Evansville chapter were guests at the Green River Steel Corp. in Owensboro, Kentucky on June 14. The tour of plant operations included loading of furnaces,operation of electric furnaces, filling of ladles, pouring of ingots, soaking of ingots, forging by a new process called the "Dornin process," rolling mill, cutting to length and shipping.

After the tour the guests retired to Gabe's for dinner which was followed by a question and answer period, conducted by Charles P. Hammond, general manager of Green River Steel, and his staff. —*Guenther F. Wulf*

Syracuse Chapter Hears Automation Talk

Frank Rives, a specialist on automation and mechanization at the General Electric Co., Syracuse, was the featured speaker at the June 8 meeting of Syracuse chapter at Hotel Deauville Auburn. He discussed "Automation and the Automatic Factory" before 134 members and guests, giving a brief review of recent trends toward automation in machine tool design.

An announcement was made of the forthcoming annual clambake to be held on August 21 at Hinderwadel's Grove proceeds of which will go toward a scholarship award. —*A. A. Lachner*

Rockford Chapter Awards Contest Winners

Eight local high school students received cash awards from the Rockford chapter at the culmination of the spring drawing contest. The contest involved redesigning of a universal joint and the awards were made on the basis of originality and drawing excellence.

First prize was $25 and a pen and pencil set; second, third and fourth were $15, $10 and $5, respectively. Instructors from Beloit and Freeport were invited by the education committee to view the winning drawings.

The evening technical speaker was Dorian Shainin, industrial consultant at Rath & Strong in Boston. The title of his talk was "Quality Control Can Help Solve Difficult Machine Tool Problems." —*Les Teachout*

Canton Chapter Visit Local Plants

Members of the Canton chapter numbering some 75 toured both the Cleveland Tapping and Automatic Steel Products plants in Canton recently. The trip through the plants was preceded by a social hour and buffet supper.

One of the interesting highlights of the tour was observing the unique machinery designed and built for spinning pulleys used in the automotive industry. —*G. C. Hornbeck*

Dr. Harold A. Frommelt Speaks at Meeting

Consulting engineer, Dr. Harold A. Frommelt of the Detroit Milling Cutter Co., Farmington, Mich., was the speaker at the June 1 meeting of Springfield, Ill., chapter. His topic was "New Concepts of Rigidity and Surface Foot Rates in Carbide Milling." Some 50 members were on hand for this meeting at The Mill. —*Charles Collier*



SPRINGFIELD PROGRAM — Charles E. Kraus, second from left, president of Kraus Automatic Machine Corp., Rochester, N.Y., was the technical speaker at the May meeting. His subject "Hopper Feeds and Automatic Parts Handling" was introduced by Kenneth R. Blaisdell, far left. Rex Stevenson of the Kraus firm is pictured at the right.

—*George H. Foy, Jr.*

IBM Engineer Addresses Los Alamos Chapter

A program by William R. Stringfellow, engineering with International Business Machines, Poughkeepsie, N. Y., was featured at the June meeting of the Los Alamos chapter. A film on high speed computers gave a short history of the intricate machines and devoted much attention to the newest and fastest models recently designed. A lively question period indicated a good deal of chapter interest in the topic.

In May the chapter heard a talk by Jack Welsh, manager of the Cavitron Div., Sheffield Gage Co., Dayton. He discussed ultrasonic machining of hard materials, giving the history of this new technique. —*Basil Boss*

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AVAILABLE PLANT MANAGER—offering over twenty-five years of progressive manufacturing experience. Has successfully functioned as Chief Industrial Engineer, Methods Engineer, Supervisor of Tool Manufacturing, Tool Engineer and Tool Maker. Has exceptional record in labor negotiations and supervisory training. Personal habits will stand up under rigid investigation. Write to Box 501, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

TECHNICAL SALESMAN—available for manufacturer seeking experienced man in New England territory. Twenty years' association with machine tools and related equipment, most of it spent in selling industrial concerns in this region. ASTE member. Write P. O. Box 66, Boston 92, Mass.

TOOL PLANNER—6½ years in aircraft. Good background. Will relocate. Prefer East or Southeast. Write to Box 503, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

San Fernando Members Hear Martin Tregnan

"Frozen Mercury Investment Castings" was the subject of a talk given by Martin P. Tregnan, West Coast representative of Metal Parts & Equipment Co. at the June 2 meeting of San Fernando Valley chapter. An audience of 55 was at Hody's Restaurant.

—*A. J. Soares*



LONG ISLAND PANEL DISCUSSION—"Preservative Finishes for Tools" was covered by these panel members at the May 24 meeting. From left: Sam Rothstein, general foreman, finishing department, Fairchild Camera and Instrument Co.; Bert Paul, special process engineer, Fairchild Engine Co.; E. E. Hansen, assistant manager of standard practices, Arma Corp.; Durwood Armstrong, chief process engineer, Grumman Aircraft; R. G. Bowen, chief tool engineer, Edo; J. Joyce, materials engineer, Sperry Gyroscope; and W. Atchison, process engineer, Grumman Aircraft.

—*Jerome Bartus*

in the good old summertime...

Families and friends of Mid-Hudson members participated in the chapter's eighth annual picnic held on June 12 at the Elks Camp at Freedom Plains. Nearly 450 persons attended the event. Swimmnig and a full program of organized games were planned for adults and children alike. Hamburgers for lunch and roast beef for dinner, with all the trimmings, were also major attractions.—*Davis Gale*



Nail-driving was one of the many activities planned for the Long Island picnic by Gilbert Hardt and his committee. Charcoal broiled steaks headed the menu for the 250 members, guests and children who attended the event.—*Jerome Barfus*



This informal group is part of the 80 Erie members and guests who headed for Penelec picnic grounds and the chapter's eighth annual outing held on June 19. The day's activities of horseshoe-pitching, card games and volleyball were topped off with an ox roast.—*Samuel A. Fiorenzo.*



Taking a much needed rest after playing the 18th hole at Hacienda Golf Club are these Los Angeles golfing enthusiasts, from left: Bob Loffler, Ralph Chrissie, who was tournament chairman, John Czinger, and Carl Allen. —*Ralph Chrissie*



Nearly 180 members and guests of the Hamilton District chapter participated in the field day held June 3 at Glendale Golf and Country Club. Shown here are Ralph Fechnay and three friends ready to tee off.—*G. W. Hawkes*



New Haven chapter's annual outing allowed these volleyball experts to exhibit their athletic prowess and they turned in top-flight performances, winning the chapter championship.
—*S. W. Bancroft*



LITTLE RHODY SPEAKER—Thomas Monahan, center, addressed the May meeting on the topic "The Industrial Future of Our State." He is executive director of the Rhode Island Development Council. From left: Karl Friedland, secretary; Paul Watelet, second vice chairman; Mr. Monahan; William T. Nystrom, chairman; and Phil Peckham, first vice chairman.

Industrial Future Topic at Little Rhody

Some 58 members and guests of Little Rhody chapter met at Johnson's Hummocks to hear a talk by Thomas Monahan, executive director of Rhode Island Development Council. He discussed the industrial future of Rhode Island. Mr. Monahan is also president and treasurer of the Providence Body Co. of Cranston, R. I., and president of Cranston Chamber of Commerce.

C. Arnold Randall, Pioneer Mfg. Co. in Riverside, R. I., showed a film produced for the National Tool & Die Makers Association titled "Tool and Die Making." The film was provided by Lawrence Cook, president of Lawrence H. Cook Co. of East Providence.

—Richard H. Kilbane

Lima Chapter Observes Second Birthday

Lima celebrated its second birthday in May by staging a dance in the Elks' Home. The attendance was officially listed at 232 members, wives and guests for the event. Music was provided by Henry Armantrout's Combo, and at intermission time the traditional birthday cake was cut and served.

Since the chapter started two years ago, membership has increased from 92 to 152.

Past Chairman Evan Fieghtner presented the service award pin to Cyrill N. Sterrett on behalf of the executive committee for his outstanding job as chairman of the public relations committee and capable handling of the chapter's monthly bulletin and releases to the local press. *—Donald Cox*

Hartford Holds Education Night

Cecil E. Herring of the Meehanite Metal Corp. addressed the June 7 meeting of the Hartford chapter. His discussion of "Quality Castings, the Key to Efficient Production" was followed by a sound film and a question and answer period. The technical session, held at the Hartford Gas Co., was preceded by dinner and the presentation of scholarship awards at the City Club.

—A. Douglas Proctor

Detroit Chapter Hears Six-Member Panel

A panel of six discussed "Recent Developments in Metal Cutting Research" on May 13 before a meeting of the Detroit chapter. Members of the panel were: Milton Shaw, professor of Mechanical Engineering at the Massachusetts Institute of Technology; Lester Colwell, professor of production engineering at the University of Michigan; and Kenneth Trigger, professor of mechanical engineering from the University of Illinois; Alfred Schmidt of Kearney & Trecker Corp. of Milwaukee; Hans Ernst; and Norman Zlatin, partner of Metcut Research Associates in Cincinnati.

The professors gave reports of developments from their educational centers; Mr. Schmidt and Mr. Ernst reported on research done at their machine tool building companies; and Mr. Zlatin told of statistics made for the U. S. Government. Moving pictures were also shown of cutting steel and titanium filmed at 7,500 frames per second.

On May 20, in the Junior Room of the Engineering Society of Detroit, junior chapter members gathered to hear Dale J. Madden, vice president of public relations for Leadership Training Inc. (Dale Carnegie courses). He emphasized the importance of human relations in all phases of our lives and the importance of the individual man in today's complex economic and social order. *—Walter R. Schober*



LIMA'S SECOND BIRTHDAY—Mrs. Evan Fieghtner, wife of Past Chairman Fieghtner, cuts the cake which highlighted the celebration of the chapter's second anniversary. At the left are Past Chairman Ray Schimpf and Mrs. Schimpf. Richard Shaw and Mr. Fieghtner watches the proceedings from the right.





AKRON'S FATHER AND SON NIGHT—Dads and little shavers, some not so little, turned out in full force for the chapter's tour of Goodyear Tire and Rubber Co. The group witnessed the production of tires and visited the company museum which shows exhibits on the history of rubber. In the righthand photograph, Frank Flannery, Ted Bushnell and Lou Bokany are pictured taking an imaginary flight in one of Goodyear's balloons at the museum.—*Ted Bushnell*

Indianapolis Members Enjoy Annual Picnic

A variety of outdoor activities greeted the 125 Indianapolis members and guests who attending the chapter's annual picnic held June 5 at Noblesville, Ind. Heading the list of sports were golf and softball, with swimming and tennis a close second for popularity. Prizes were distributed through the courtesy of local industrial firms. Chicken for dinner provided the necessary and most welcome nourishment.

—*Murray Davidson*

Madison Speakers Discuss Nylon

"Injection Molding of Nylon" was discussed May 20 at a meeting of the Madison chapter held at Janesville, Wis. Technical speaker was Bailey H. Barnes, sales representative from the Chicago office of DuPont. He was assisted by Dr. R. B. Akin and R. T. Black of the same firm. Slides and samples helped illustrate the talk. The meeting was held at the Monterey Hotel. —*L. A. Havey*

Racine ASTE Members Attend Annual Frolic

A crowd of 435 attended Racine chapter's 19th annual frolic held at Liggett's Royal Palm Gardens, Brown Lake, Wis. The June 4 outing provided a day of golfing, fishing and games which started at noon. Dinner was a 7 p.m. followed by a program of vaudeville acts and card games.

—*Alvin J. Michna*

Positions Available

SALES REPRESENTATIVES—An old established engineering and manufacturing firm requires the services of several sales representatives. Company products consist of master spline and gear gages, indexing plates and fixtures, powder metal dies, miscellaneous production machine products. The company products are adequately advertised. Applicants selected will be given exclusive territories on an attractive commission basis. Submit resume, stating experience and qualifications to S. L. Mayes, 6577 Alden Drive, Pontiac, Mich.

MANUFACTURERS AGENT WANTED —by Eastern concern to represent them in St. Louis industrial area. Firm manufacturers wide line of precision tools and machine tools. Write to Box 502, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Nebraska Chapter Takes Plant Tour

A tour of the Demster Mill Mfg. Co. plant at Beatrice was enjoyed June 17 by members of the Nebraska ASTE chapter. After the visitation, a talk on optical gaging was presented by Ted Foreberg of Optical Gaging Products, Inc., Cedar Rapids, Iowa. The programs were preceded by dinner served at the Steeple House Club. —*T. C. Jones*

Outing Ends Season for Fairfield County

Fairfield County ASTE members closed the current season with an outing held on June 5. About 80 attended the event held at the Nash Engineering Co. in South Norwalk, Conn. The day's program included a full sports agenda and plenty of good food served picnic style. —*Henry E. Busby*



SAN GABRIEL VALLEY FILM PRESENTATION—The 85 members who attended the June 3 meeting saw movies on "Alignment" and "Chips for Profit" and also participated in a panel discussion. Pictured are: Irv Greensides, chairman; Robert Hayward and Herbert Bingham, program speakers; Lincoln Mager, treasurer; and Ed. Cutler, first vice chairman.—*J. S. Wajdik*

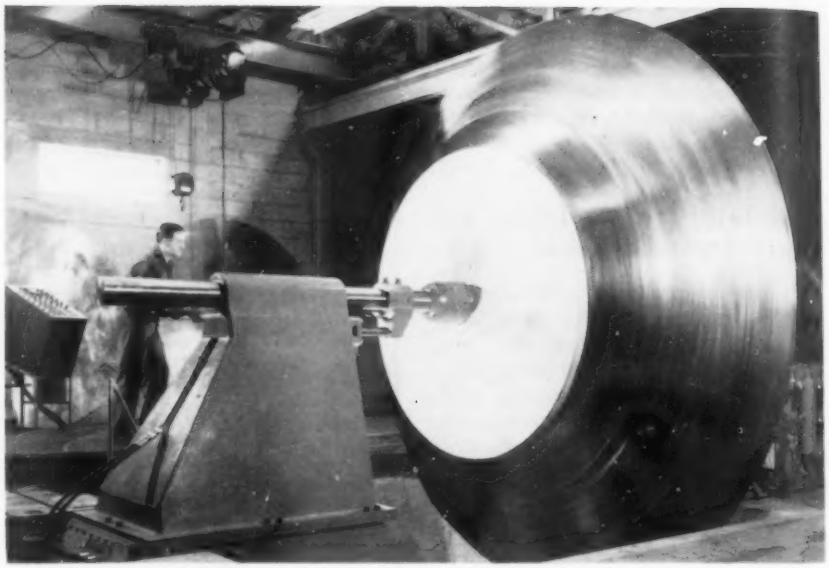
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METAL WORKING

SPINNING BEGINS ON WORLD'S BIGGEST UNIT

The largest horizontal spindle metal spinning lathe ever constructed has been installed at the Phoenixspun Div. of Phoenix Products Co. The lathe, which has a 180-in. diameter swing, was designed particularly to produce larger spun shapes needed in atomic energy plants and industrial air-conditioning equipment. Results of advance studies were used in calculations to determine horsepower-pressure requirements to accommodate spinning of tough metals including stainless steels, chrome-moly steels, cupro-nickel alloys and titanium alloys. Operation of the hydraulically controlled unit is through a portable pushbutton control panel, controlling speed of the 50-hp drive, clutches, brakes and all movement of the tailstock. The spinning tools are hydraulically actuated and pressures needed for hot spinning can be built up to an unprecedented point.

Prior to this time, industry generally has not been able to spin shapes larger than the 104 in. Since sheet metals normally are available in 72 and 85-in. widths, blanks for larger spinnings must be made from carefully welded sections. For all nonferrous metals the inert gas method is used because welds must have 100-percent penetration and be ductile.



Here a 14-ft dome for air-conditioning equipment is formed on the world's largest spinning lathe.

Normal conventional spinning never goes over $\frac{1}{8}$-in. maximum in thickness and, depending on the metal, more than 26 in. in depth. However, with this new machine, as heavy as $\frac{3}{8}$ in. thick steel and $\frac{3}{4}$ in. thick aluminum is possible with a depth of 72 in.

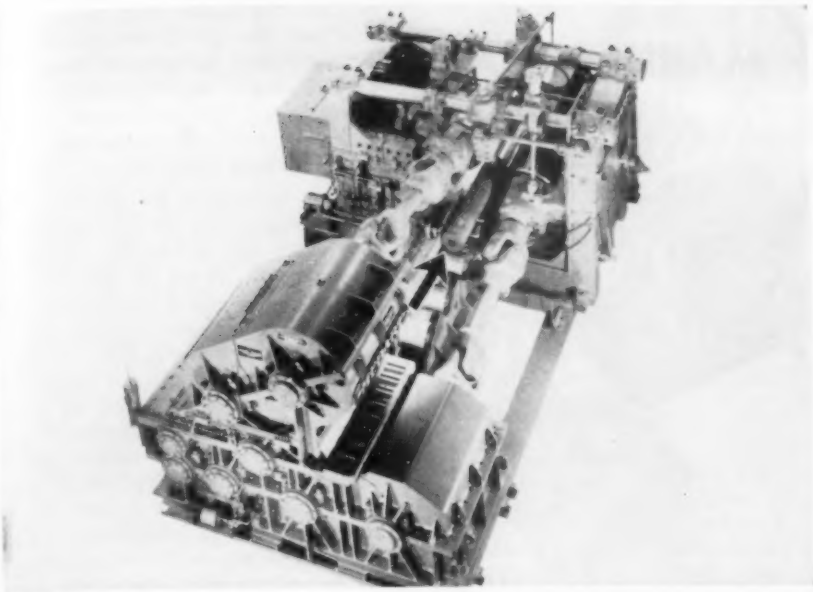


LUBRICATING BY SPRAY DOUBLES MACHINING SPEED

Speeds attained in operations for roughing and finishing the inside surface of cast aluminum tire molds have been doubled through utilization of the Spray-Lube System of applying cutting liquids, recently introduced by the C. A. Norgren Co.

The system replaces air cooling which was used previously at O.K. Rubber Inc., on this operation performed by a large vertical turret lathe. As a consequence of the altered process, surface cutting speed has been stepped up from 45 to 75 fpm, while depth of cut has been increased to 0.006 in.

Introduction of this system into the operation has also served to avoid a serious tool repair problem. With the former method of operation, chips had inadvertently been welded to the cutting edge of the $14\frac{1}{4}$-in. face form tools. Not only is there now a big savings in tool repair, but quality of the finish is higher since galling of workpieces has ended.



ROLL STRAIGHTENING WITH 500-TON PRESSURE

All-automatic, this 2-roll continuous rotary straightening, sizing and polishing machine is the largest machine of its type in the world. Roll-bearing capacity of the unit is in excess of a million pounds. Built to accomplish precision straightness from end to end of a workpiece, it will handle tubes or bars from 3 to 10½ in. in diameter and as short as 3 ft. in length. Short lengths are discharged from the straightening section by means of a set of powered conveyor rolls.

Because of its size and weight of components, the weight of the machine is 147,000 lb; the machine is equipped with power-operated controls on all adjustments. Thus, an operator has only to actuate the hydraulic controls and the machine will close down automatically to a minimum diameter of 3 in., or open to a maximum of 10½ in. diameter. The angle of the straightening rolls is also power adjusted automatically.

An arrow in the photograph points to the tube being straightened. In this case the tube is of 52100 SAE steel, and is 10½ in. in diameter with 4 in. walls.

Power for the machine is provided by a 200 hp direct-coupled DC motor. Each of the universal joints is capable of transmitting 100 hp. A self-contained coolant pump circulates coolant in the roll housing section over the rolls, while a self-contained oil pump and filter circulates oil in the gear box.

The straightener was built especially for the Timken Roller Bearing Co. mill at Canton, Ohio, by The Medart Co. of St. Louis.

PLASTICS BROADEN FIELD FOR METAL STAMPING

Demonstration of the practical use of conventional metal-stamping equipment for the rapid forming of rigid vinyl plastic products has been made by the B. F. Goodrich Chemical Co. and was shown publicly at the recent national Plastics Exposition. Most importantly this points the path for diversification of operations for many metalworking companies since they can move into the plastics field with little capital outlay.

Up to now, special processing of rigid vinyl plastic required special expensive injection molding machines and slow hand-operated draw-forming or blow-forming presses. Now, using the new method, a fast conveyor belt proc-



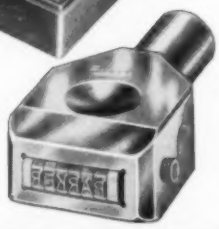
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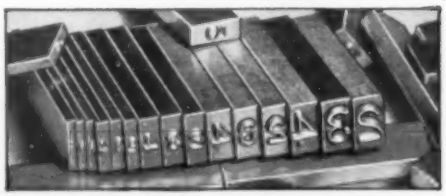


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ess takes the plastic sheet from a preheat oven through to the conventional metal-stamping press which forms the finished shape, depending on the type of die design. The end product is completely finished and requires no additional finishing operations.

Vinyl material is the same type of plastic being used for oil field pipe, road signs and piping and machinery for industries where its light weight, strength and resistance to corrosion and chemicals are of special value. It was with this same material that the Goodrich Chemical Company demonstrated its method of forming by molding boxes from 1/20-in. thick rigid sheeting which had been embossed on one side with a weave-like texture. The plastic sheeting is fed from reels under a bank of strip heaters to raise its temperature to 260-275 F. Two sets of driven rubber rollers control the movement of the sheet. A clutch arrangement causes intermittent feeding of the sheet to a conventional metal-stamping press. Cycle time is 10 seconds and the stock is cut off during the molding operation.

Standard matched molds have a clearance of 0.050 in. between the core and the cavity. Design calls for a 0.003-in. tolerance overall, and 0.001 in. on the cutting edge. The finished boxes conform to the same tolerance.

PLASTIC FIXTURE HOLDS ODD-SHAPED WORK

Faster, less expensive machining is being accomplished at Chance Vought Aircraft, Inc. due to an ingenious plastic mill fixture used to hold odd-shaped pieces by vacuum during the work.

The innovation came about as a result of the numerous odd-shaped castings required by the aircraft industry. By ordinary methods these pieces would have to be set up and clamped separately. Chance Vought's plastic shop cast a phenolic resin block for the piece to

Cast phenolic plastic block holds odd-shaped casting for quick milling by vacuum clamping. Suction through an airline at the lower left holds the casting in place during milling.



milled. The center portion of the k was cast, using a production part pattern, and a vacuum hose at- ed to a steel lead-in pipe in the er portion of the block. Standard ings are cast in place to provide a al. About 20-minute setup time is eded for the first particular casting th this type fixture, with only six onds required to place subsequent arts in the vacuum holding fixture, hich is clamped on the bed of the illing machine.

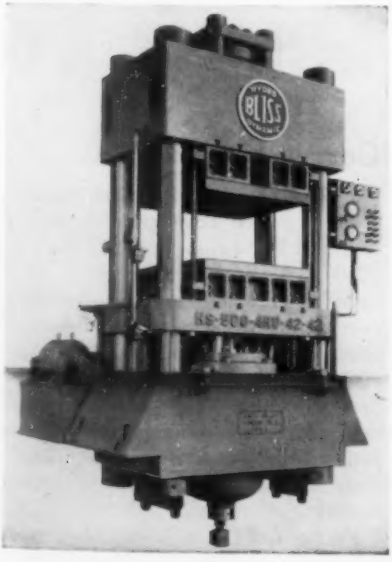
Tests reveal the vacuum block most uitable for climb milling.

As much as 50-percent savings over conventional mill fixtures was claimed for the idea which required no tool design.

LARGE TRANSFER PRESS DOES PLASTIC FORMING

Quick advance and slow pressing speeds with precise pressure controls for the forming of complex structures, are combined in the design of this 500-ton hydraulic transfer molding press for forming plastic parts in a closed die. The giant unit was only recently completed at E. W. Bliss Co.'s Canton plant. Open tie rod construction facilitates handling.

After being manually loaded into the transfer cavity at the beginning of the work, the plastic pre-forms are moved into the die cavity by pressure of the transfer ram. Pressures from the main ram and the transfer ram are maintained until proper curing is accomplished. Both rams then retract, with the main ram activating mechanical knockouts to release molded parts.

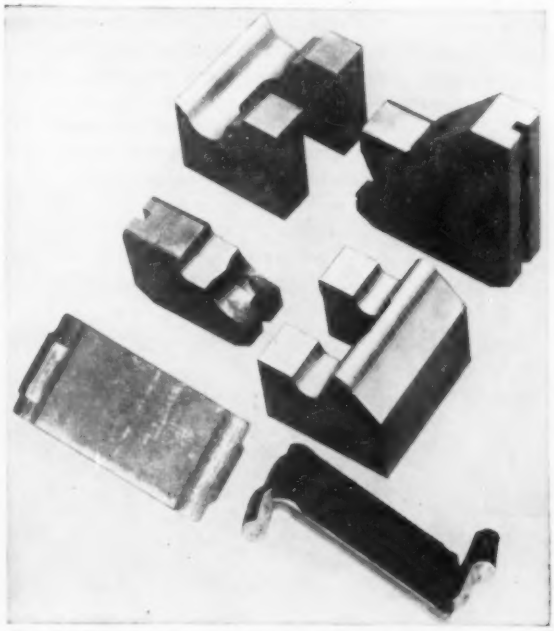


50%* to...???

INCREASED PRODUCTION, PROVEN WITH . . .

Darwin PRK·33 TOOL STEEL

For the extra performance and savings you want from better wearing tools and dies—less downtime for retooling or regrinding and longer, more economical runs—it's not the first cost, but the "plus" of Darwin PRK-33 that counts. The unique composition of added Cobalt, Chromium, Nickel, Manganese and Molybdenum give PRK-33 both stainless and non-corrosive qualities—**plus, rigorous durability.** If you are now using standard 150 carbon, air hardening high chrome tool steel, it will pay you to call or write today about the savings you can effect with PRK-33!



PRK-33 dies and automobile door hinge blanks. Stock ⅜" thick, H. R. 1020.

* REPORTED BY PRK-33 USERS

HOT COINING DIES—Increased production from previous high of 7,000 pieces to 16,100 (130% increase) without sign of heat or wear cracks.

KNURLING TOOLS—Beats not only High Carbon—High Chrome but also High Speed Steels in many cases. One case reports 50% better than High Speed Steels.

DRAWING DIES—Philadelphia concern did over 60,000 pieces per grind, against previous best record of 16,000.

Complete line of highest grade Tool Steels, including PRK-33, DARWIN No. 1, NEOR, MINEOR, OHT, "MT6" and various grades of Hot Work Specialty Steels. Furnished in Bar Stock, Billet and Sand Casting, Drill Rod, Flat Ground Stock and Tool Bits. Bulletin on Request.

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ZIV STEEL & WIRE CO., CHICAGO • DETROIT • ST. LOUIS • INDIANAPOLIS • TOLEDO • MILWAUKEE • M. G. OPP COMPANY, NEW YORK CITY • PECK STEEL & DIE SUPPLY COMPANY, LOS ANGELES • CHARLES B. WEBSTER, PLAINVILLE, CONNECTICUT • CHARLES W. BRINGMAN, ORLANDO, FLORIDA

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-107

TOOLS of today

Non-Rigid Cutting Tools Offer Speed and Economy

Designed on an unusual principle, the Mech-Grip milling cutter, produced by St. Clair Tool Corp., offers several advantages to users; floor-to-floor machining time is reduced 20 per cent over conventional methods; carbide usage cost is cut 80 percent; tool change time is reduced an average of 90 percent; need for grinding and brazing of tools is eliminated; and no time is needed for tool resizing.

Contrary to conventional milling and turning tools, Mech-Grip cutting elements are nonrigid, permitting the cutting piece to give with shock during work. Cutting edges overhang the shank support edge of tool to permit tip assembly to absorb greater shock without damage. The cutting tip is mounted on a supporting plate about the same size as the tip, and is held in place by a clamp canted in relation to the tip surface. The tip touches the clamp only at its front edge. As a result of this construction, the tools have the ability to move and thus absorb shocks which normally would prove destructive.

The cushioning effect produced by the design of these tools reduces minute chipping of the edge, offering considerable increase in tool life.

A further advantage of this design is that a cut may be stopped while the feed is on without damage to the point.

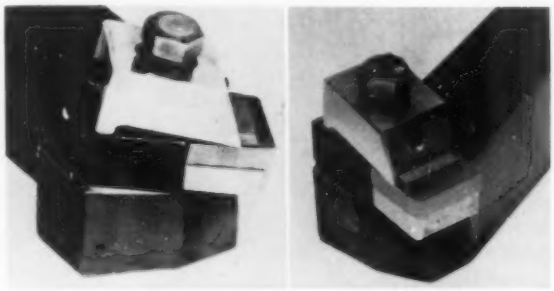
Protection afforded by the design permits practical machining of materials normally considered too hard for economical work. Harder tip material is used in the tool and this combined with the nature of the design permits considerably higher cutting speeds—up to 200 percent greater than those normally obtainable.

A brochure is available from the company in Livingston, N.J. **T-8-1081**

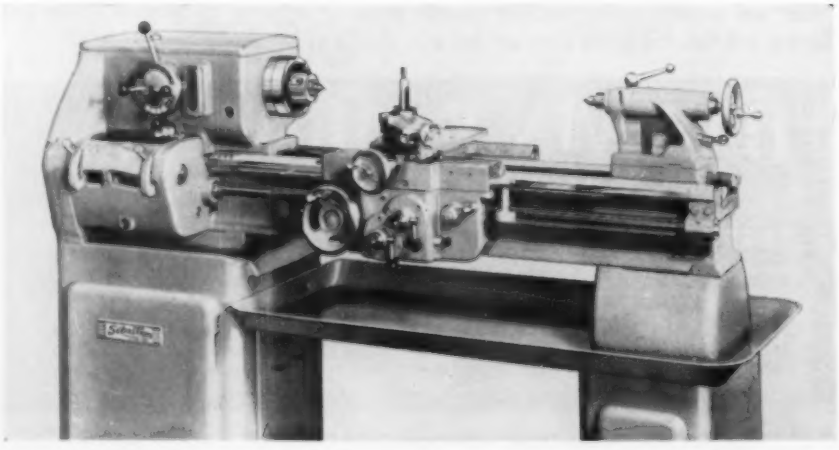
USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION



Above. Milling cutter contains non-rigid elements. Adjustable cutting tips can be indexed eight times.



Left. Close up views of the Mech-Grip tool holder show clearly the arrangement of the cutters. This is the same principle used in the milling cutter unit.



Geared Head Lathe

Functional design of the Sebastian 13-inch geared head lathe recently introduced by Sheldon Machine Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill., is aimed at, promoting easy operation, incorporating the latest in an automatic oiling system, cam action tailstock clamp, and easy-shifting spindle speed dial. Nineteen tests run on each lathe insure extreme accuracy of every unit and the individual test sheets accompany each lathe when shipped from the factory.

Features of the lathe include a thick-

...d, hardened and ground multiple-...d spindle supported by "zero pre-...g" tapered roller bearings for long-...ccuracy.

...gearbox which is enclosed has ...different pitches and feeds.

A cam-action tailstock clamp permits rapid shifting of the tailstock. The carriage is massive, has an extremely large bearing surface. A built-in one-shot oiling system provides lubrication for all bearing surfaces. Two friction disk type clutches in the large apron provide power longitudinal and power cross feed. These clutches can be engaged individually or simultaneously.

Complete details of the geared head lathe are given in an illustrated brochure from the company. **T-8-1091**

Ram-Type Milling Unit

A medium-size ram-type precision milling machine, designed to utilize high-speed steel cutters while offering the speed and rigidity necessary for use with carbide cutters, has been



placed on the market by Fray Machine Tool Co., 2935 N. Ontario St., Burbank, Calif.

The machine, identified the Model 1½V, features two table sizes: 9 x 36 in. with 22-in. longitudinal travel, and 9 x 42 in. with 28-in. longitudinal travel.

The milling head is equipped with both lever and handwheel feed in a wide range of speeds: the standard ranges from 450 to 6400 rpm in 6 speeds; optional back gear unit offers 150 to 6400 rpm in 8 speeds and a third gives 75 to 6400 rpm in 16 speeds.

Extra capacity is provided by the



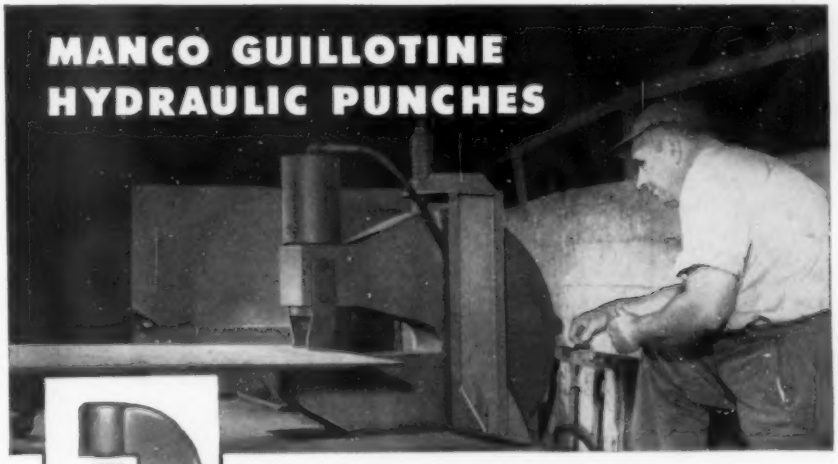
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TOOL COLUMBIA STEELS

MANCO GUILLOTINE HYDRAULIC PUNCHES





Model P-20-186
Capacity 1" hole in ⅜" mild steel. Reach 1⅜". Weight 44 lbs. Available with high-speed electric hydraulic or portable manual pump.

HIGH CAPACITY . . . STRUCTURAL OR FIELD WORK

There is a wide variety of fast, powerful Manco Guillotine Hydraulic punches with varying capacities, available for stationary production use, semi-portable boom-mounting, or complete portability for use in the field. Model P-75-E, above, equipped with Manco high-speed electric hydraulic pump offers 75 tons thrust and capacity for 1" hole in ¾" steel. Other models up to maximum capacity for punching 3¾" hole in 16-gauge sheet.

Write, stating requirements: hole size, location, quantity, accessibility, material punched

Dept. T-8 **MANCO MFG. CO.**
Bradley, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-109

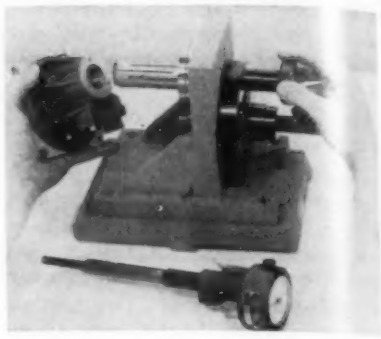
heavy-duty dovetail ram assembly, made in two models, giving the milling machine a 12½-in. standard ram travel or a 20½ optional ram travel.

Among the chief advantages of the unit are its accuracy and speed of operation. Equipment includes a precision milling head, a heavy-duty quill type attachment, permitting the operator to work to close tolerances. The quill has 3½ in. of travel, and its weight is adjustably compensated for sensitivity. **T-8-1101**

Go and Not Go Gages with Adjustable Jaws

A total range from 0.708 to 2.835 inch is now possible with only six adjustable Go and Not Go gages recently introduced by Ardec, Inc. of Media, Pa.

The Ardec gages can be set quickly with micrometer, indicator or Johansson block, depending on accuracy required. Each gage has long jaws similar to solid Go and Not Go plug gages to permit straight entering. Blind holes



can be measured to their full depth as easily as through holes. Bores can be gaged for "out-of-roundness."

After an Ardec gage is set, it can be locked and wax-sealed to prevent tampering.

If settings of Go and Not Go plug gages are in increments of 0.001 inch, one set of six Ardec gages replaces 2,126 regular plug gages. **T-8-1102**

ARDCOR Engineered

MEANS BETTER COLD-ROLL FORMING

The Production-WISE

ROLL FORMING MACHINE...



ARDCOR

MODEL 1-F

Spindle Diameter	1½"
Roll Diameter	4¼" to 7"
Horizontal Distance Between Spindles	12"
Roll Space on Standard Machine	10"
Capacity Max.	.072

ADAPTABILITY — Ardcor Standard Forming Machines feature "unit construction" for each stand. Thus production changes are easily and quickly made. With this feature, any length base can be furnished to accommodate additional units as required.
Ardcor Roll Forming machines embody the precision, accuracy and stability found only in the highest grade machine tools. In addition, Ardcor offers a completely engineered installation—cradle reels, roll forming machines, roller dies, flying cut-off fixtures, etc.—from one qualified source.
Likely as not your special shapes can be ideally handled by a standard Ardcor machine. Your inquiry is invited—without obligation.

American ROLLER DIE CORPORATION

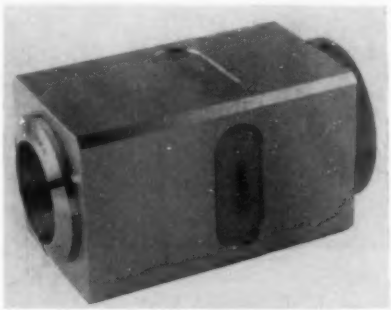
29540 Clayton • Wickliffe, Ohio

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-110

Indexing Fixture

Accurate 90-degree indexing of round stock for cutting squares, splines, keyways, flutes and special tools can be simplified with the Brown block chuck. The indexing unit is a hardened and ground steel block with a precisely centered collet seat and drawnut; it is square and parallel within 0.0005 in.

The block chuck is readily applicable to lathes, milling machines, sur-



face grinders or drill presses with a minimum of setup time. With a workpiece clamped in the collet, the block is simply held in position by a four-jaw chuck, magnetic chuck or vise, and turned 90 or 180 degrees after each cut is finished. There is no need to release the work from the collet until the job is done.

Low in cost and designed to save time and simplify setups, the Brown block chuck handles an infinite variety of work. Rectangles, parallel flats,

punches, broaches and holes drilled at right angles are simple operations.

Properly placed, it enables the user to index compound angles, or to accomplish octagonal indexing and other work involving increments of rotation of 45 degrees. Economical jigs and fixtures can also be designed around the basic block.

The unit is manufactured by M and H Products, Inc., Box 1057, Danbury, Conn. **T-8-1111**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Grinding Coolant

Triple C, a coolant for all wet grinding operations, has been placed on the market by The Motch & Merryweather Machinery Co., Cutting Tool Div., 1250 E. 222nd St., Cleveland 17, Ohio. It may be put directly into water in the grinder, dissolving taking place in as little time as two minutes. It is compatible with heat-treating salts, makes stable solutions, maintains its properties no matter how hard the water, and will not impair filtration equipment operation.

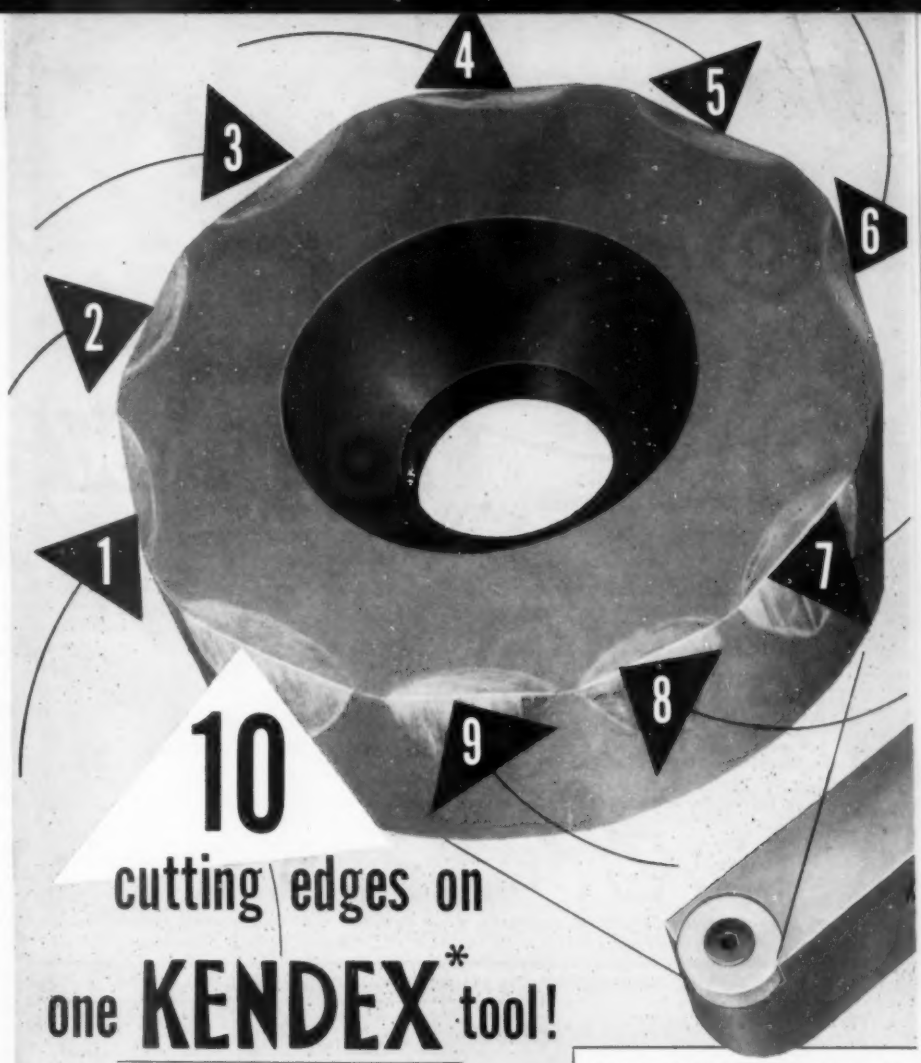
It is foamless, odorless, makes transparent solutions, and does not make ground materials slippery to handle when wet. Triple C dissipates heat quickly. Its solutions have no emulsifying action on oils or any deterrent effect on lubricated parts of machines. Even if thrown directly into sewers or streams it offers no contamination hazard. **T-8-1112**

Hole Location Gage

Hole locations and hole concentricities can be checked with the utmost accuracy by a standardized hole location gage produced by Federal Products Corp., 1144 Eddy St., Providence, R. I.

Designated Model 205, these precision instruments can be used to gage location or alignment of the hole in the workpiece with respect to another hole, a surface, or a predetermined reference; and also concentricity of a hole with another finished hole.

A master fixture with a precision bore is built that will enable a relationship to be established between the bore in the fixture and the hole in the part. A single contact gage is located in the fixture by means of a locating



10 cutting edges on one KENDEX* tool!

No tool grinding expense and *minimum* machine down time for tool changing—these are the advantages you obtain from multiple-edge Kendex "throw-away" insert tools. For example:

A Kendex round insert, used to bore 2½" cast iron stators, machined 300 pieces before one cutting edge dulled. Then, without removing the shank from the boring bar, the "button" was revolved to a new cutting position, until 3,000 stators were machined with the insert's 10 cutting edges. Best previous performance, by a conventional brazed tool, was 400 stators per tool grind.

Kendex precision-ground buttons have Kennametal's high wear-resistance, for long life. Screw-mounted, they can be rotated in seconds to new cutting positions without removing or resetting the tool holder . . . a great time-saving feature. When all cutting edges are used, the insert is thrown away—replacement cost is slight compared to that of regrinding.

Only Kennametal makes Kendex "throw-away" inserts. Ask your nearest Kennametal tool representative to help you apply this cost-saving tooling to suitable operations in your plant. Kennametal Inc., Latrobe, Pa.

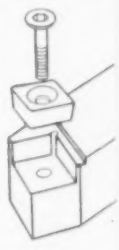
*Registered Trade-Marks

How KENDEX* Works



1

Hard, strong, wear-resistant Kennametal is molded into square, round, or triangular Kendex inserts, which are precision ground.



2

Kendex inserts are mounted to suitable tool holders with socket head screws.



3

When edge becomes dull, insert is turned to new cutting position. When all cutting edges have been used, insert is thrown away; no regrinding.

KENNAMETAL*

CEMENTED CARBIDE TOOLING THAT INCREASES PRODUCTIVITY



A-8

SALES OFFICES IN PRINCIPAL CITIES

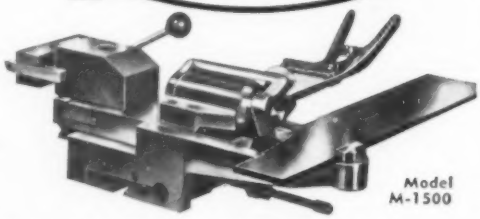


Precision
DUPLICATING
on ANY Engine or Turret
LATHE

Lehigh
TRACER-TOOL
PROFILE-TRACING
LATHE ATTACHMENT

No Complicated Hydraulic or Electronic Controls

Fast set-up for short or production runs. Requires no permanent lathe alterations. Accommodates all types of tool holders, square turrets, grinding attachments, clapper boxes, boring bars, etc. For contour turning, facing, grinding, boring, Bullard operations. Unlimited radii, 90° steps, threading to a shoulder, etc. Uses low cost, easily made templates. Models for all lathes 9" to 24" and larger. Thoroughly proven in shops and plants of every size.



Model M-1500

Write for catalog or engineering help on any duplicating problem

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1508 LEHIGH DRIVE, EASTON, PA.

Manufacturers of LEHIGH Air Valves • Air Cylinders • Air Hoists • Air Motors

West Coast Dist.: CAMPBELL CONTOUR ATTACHMENT CO., 1320 W. Esther St., Long Beach, Cal.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-112-1

THE PERFECT MATE FOR ALL FINE INSTRUMENTS OF STANDARDS

UNI-V-BLOCK by Precision Tool

Made of close grain, stabilized Chrome-Moly alloy to guarantee precision results every time. The exclusive new FROZONE process, for hardness and stability, makes *UNI-V-BLOCKS the closest thing to absolute perfection, on the market today!*

Shown here is MODEL No. 3000 (2½ x 3¾ x 2 15/16")
UNI-V-BLOCKS are also available as:
MODEL 5000 (4¾ x 5⅛ x 5⅜")
MODEL 1250 (1¼ x 1¼ x 1⅜")



ACCURATE TO WITHIN .0002" T.I.R.

FREE! WRITE NOW FOR MORE INFORMATION!

PRECISION TOOL & MFG. CO. OF ILLINOIS

1305 S. Laramie Avenue

CICERO 50, Illinois

PRECISION TOOL & MFG. CO. OF ILLINOIS
1305 S. Laramie Ave., CICERO 50, Illinois TE-8
Gentlemen: Please send me complete data on the new UNI-V-BLOCKS, at no obligation to me.

NAME
COMPANY
ADDRESS
CITY ZONE STATE

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-112-2



tube that is precision ground and lapped.

Because Model 205 gages are so frequently used with a precision master fixture, Federal also supplies the design for the master fixture as well as the complete gage as a "package." There are twelve basic gage designs around which the master fixture can be designed, these twelve meeting most requirements.

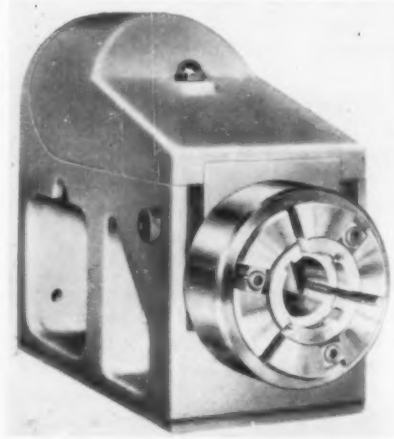
Each gage is built to check one single dimension, although on the larger sizes some contact adjustment is possible. All models are available with indicators graduated either 0.0005 or 0.0001 inch.

T-8-1121

Air Collet Chuck

This air collet chuck, designed specifically to mount horizontally or vertically on indexing tables to speed up production operations on castings and screw machine parts, accepts castings of wide variations in size and shape, registers the parts in exact position each time.

Design permits the handling of castings where tolerances are required for



...iations as much as 1/16 inch, thus ...iding unnecessary grinding. It also ...nts on drill presses and milling ma...nes. It is supplied with one master ...llet and one set of soft pads, or one ...lid collet for round or hexagon parts, ...d other collets or pads for special ...aped parts can be supplied. Air con...ol valves for hand or foot operation ...e available as accessories. Capacity ...model shown is 3/8 to 1 7/8 inch, net ...eight 35 lb.

Full details are available from Pitt Industries, Dept. TE, Carnegie, Pa.

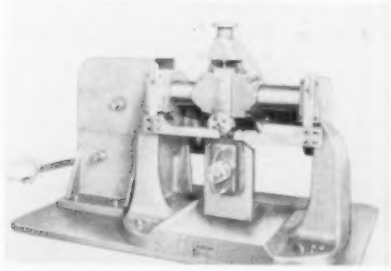
T-8-1131

Power-Operated Marker

A power-operated marking machine, Model No. 99-A, has been added to the Acromark line produced by The Acromark Co., 607 Morrell St., Elizabeth, N. J. The redesigned unit was evolved from the company's original No. 99 hand-operated marking machine, although the power assembly is completely new.

The new machine makes marking of large assembled parts possible and practical whether the marking is to occur on either a flat or curved surface.

Although feeding and removal of work is manual, marking is accomplished automatically. For other than



large work, automatic feeders and ejectors can be readily attached. An operating lever at one side of the gear reduction box enables the operator to stop and start at will. All operating parts with the exception of the marking die are completely enclosed for safety. The adjustment is sufficient to take variations up to 2 inches and the length of the stroke is 8 inches.

The over-all size of the machine is approximately 24 inches high by 18 inches deep, including the motor mounting, and the over-all width left to right is 36 inches. A part 9 inches or less in thickness can be marked in this machine and the speed of operation can be determined by the operator by simple adjustment or by feeding requirements. Lightweight parts can easily be marked at the rate of 20 pieces per minute.

T-8-1132

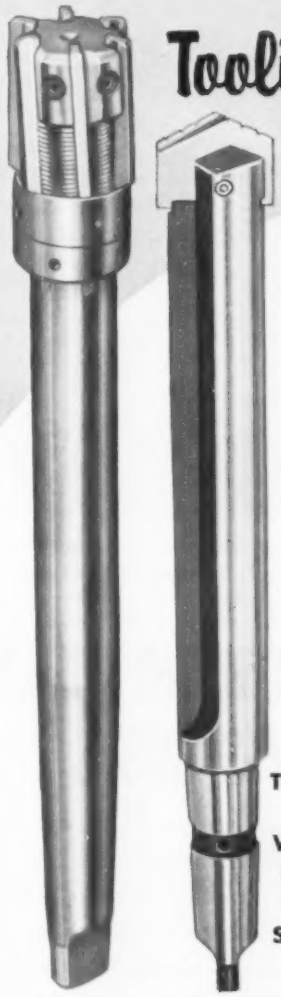
Adjustable Clamp

Improved production, maintenance and safety are important advantages provided by the adjustable clamp made by the Safety-Adjustable-Hold-Down Clamp Co., 600 Albany St., Brunswick, Ga.

Quick setup time, affords flexibility with greater speed and consequent reduction of cost.

The clamp, which is equally useful for precision or production work, gives





Tooling Costs Go Down

when you Specify Standard Inserted-Blade Cutting Tools by WAUKESHA...

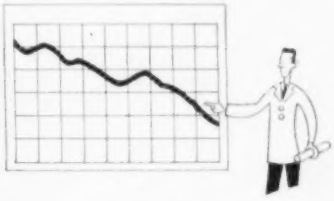
The basic economy of the inserted-blade principle, combined with the exclusive quality features of Standard Waukesha Cutting Tools, can help you reduce tooling costs on your reaming, drilling and boring operations. Cost records in all sizes and types of metal-working plants show a definite downward trend wherever these Standard Tools are used consistently.

consult WAUKESHA

— for competent Cutting Tool Counsel. Waukesha sales representatives and engineers can show you how to cut your tooling costs with "Standards by Waukesha" — or help you develop special cutting tools for your unusual needs.

Representatives in Principal Cities

THESE FEATURES of Standard WAUKESHA Inserted Blade Cutting Tools Save You Money



Adjustable Inserted Blade Reamers 5/8" to 6" diameter for High Speed Heavy Duty Service. Shear-cut angle blades prevent scoring.

Inserted Blade Spade Drills 1-1/32" to 5" diameter in stock sizes. Holder lasts indefinitely, only blades need be replaced.

Replaceable Blades — at a fraction of solid-tool costs — assure long-range economy.

Interchangeability — Each size Spade Drill Holder takes 1/2" range of blade sizes.

Shear-Cutting Action of blades curls chips away from stock, prevents scoring, assures free cutting, requires less power.

More Grinds per Blade — More Holes per Grind.

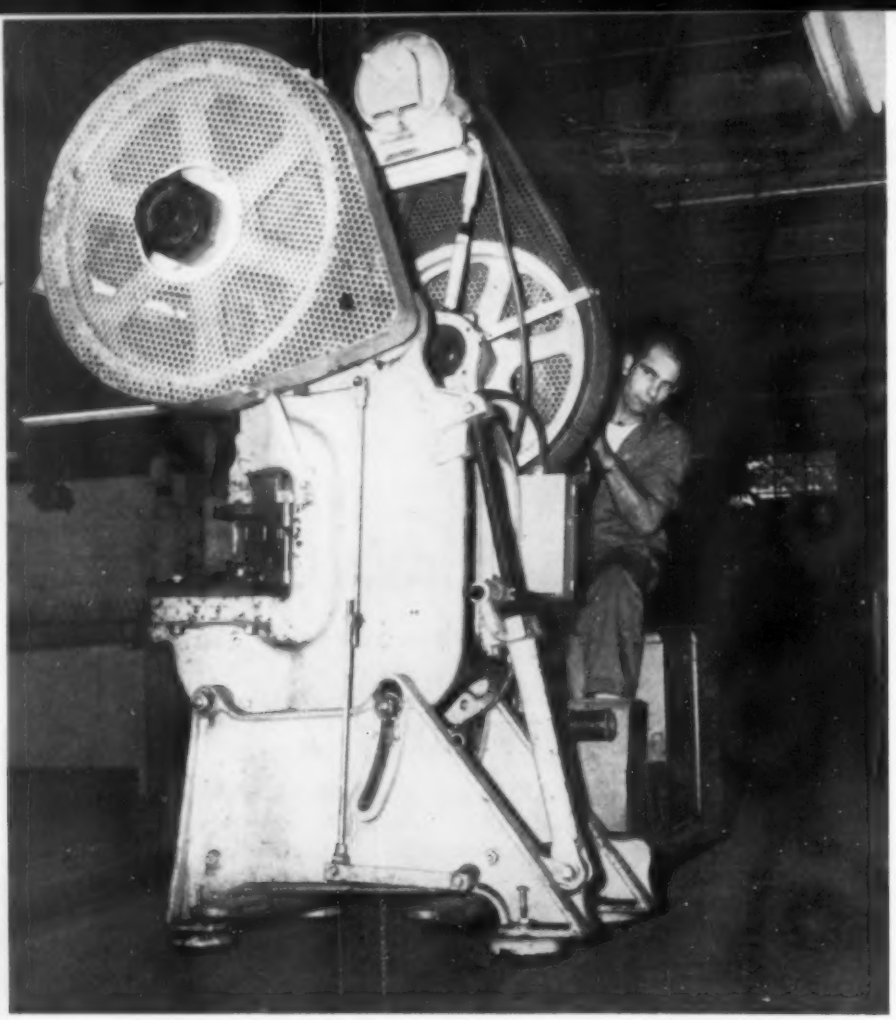
WAUKESHA TOOL CO. WAUKESHA WISCONSIN

Manufacturers of Carbide and High Speed

INSERTED BLADE REAMERS • INSERTED BLADE SPADE DRILLS • INSERTED BLADE CUTTERS • FLOATING TOOL HOLDERS • BORING BARS • SPECIAL TOOLS

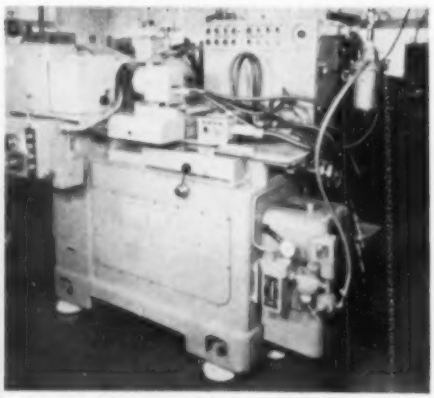
A 8015-1/2-1

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-113



NO LAGGING MADE THIS PRESS "MOBILE." This 45-ton Perkins punch press was moved 200 feet — and was out of production only 5 minutes, because it was on Leveling Barrymounts.

MACHINERY THAT MOVES WITH THE TIMES CUTS COSTS



GRINDER ACCURACY PROTECTED. Leveling Barrymounts protect this Heald Size-Matic from external shock while grinding the inner races of miniature precision ball-bearings to within tenths of thousandths of an inch.

Your product costs can be cut because mobile machinery offers you flexible production layouts. Machine maintenance and reject costs are cut because damaging external shocks are isolated. Installation costs are cut because requirements for certain foundations are eliminated—no lag bolts to set or shims to drive, yet machines will not walk.

Write *today* for the story of MACHINES THAT MOVE WITH THE TIMES

THE BARRY CORP.

928 PLEASANT STREET
WATERTOWN 72, MASS.

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

8000 psi equalized pressure with compound leverage.

Versatile in application, the lamp holds as effectively on the side of the table as on the top for drill presses, milling machines, boring mills and similar equipment. **T-8-1141**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Unusual Lapper

Spitfire Tool Co., 2931-35 N. Pulaski Rd., Chicago 41, Ill., has developed a precision tool roller-lapping machine which may be used by any shop personnel to lap metal, glass or plastic plugs, rods or pins from ⅛ to 6 inches in diameter in only about a third of the time normally required. Finishes as fine as 2 RMS or less are possible.

It consists of two precision-ground cast iron rollers with shafts extending on both sides and revolving in adjustable bearings. One of the rollers is 3



inches in diameter; the other 6 inches in diameter; both are 12 inches long and are located parallel. The large roller has dual internal air chambers vented by 4 openings for each chamber. This, plus the large mass of the rollers keeps the temperature of the work down and avoids need for cooling-off periods.

The rollers rotate in the same direction—away from the operator—and require no chucks or rings.

An abrasive compound is spread evenly over the entire surfaces of both rollers, then the piece to be lapped is placed between the rollers as illustrated. Work may be removed easily and quickly at any time for checking and measurement. **T-8-1142**

Order Zagar Collets and Collet Fixtures at These Low Prices

Zagar has a fixture for every collet tool application. Order NOW from your local tool supplier.

STOCK DELIVERY!

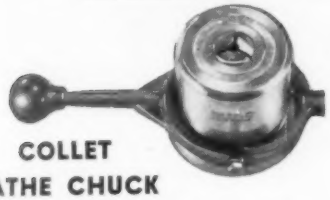
ZAGAR INDEXING FIXTURE



1"—$185
2"—$285

ZAGAR HOLDING FIXTURE

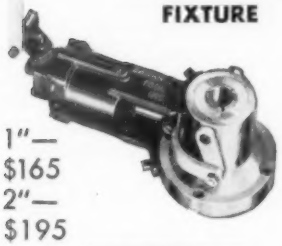
1"—$95 2"—$145



COLLET LATHE CHUCK

1"—$125 2"—$185

AIR-OPERATED FIXTURE



1"—$165
2"—$195

VERTICAL-HORIZONTAL FIXTURE



1"—$115
2"—$185

5C Collet $4.90

W & S No. 2 $6.75



ZAGAR TOOL, INC.

24000 LAKELAND BLVD., CLEVELAND 23, O.

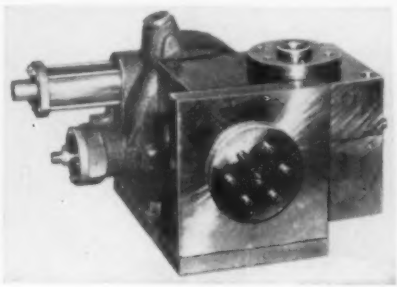
Zagar TOOLS For INDUSTRY and SPECIAL MACHINERY

INDICATE A-8-115-1

Indexing Unit

A speed indexer, designed to speed up and simplify accurate positioning, is announced by Erickson Toll Co., 23rd and Hamilton, Cleveland 14, Ohio.

This Erickson multiple position indexer No. 477 accurately indexes up to 500 positions depending on the gear ratio and index plate ordered. The original two minutes of a degree accuracy on Erickson indexers is proportionately reduced by the gear ratio.



A self-contained shock control unit, which assures positive, fast indexing, regardless of workpiece weight, can be adjusted to meet varying loads so that maximum speed can be used without injury to mechanism or work. All override is avoided.

Indexer gear box turns on the indexer spindle so the multiple position indexer No. 477 can be installed in four different positions for convenient work location. Operation is either by air or hydraulics. **T-8-1151**

Dry-Film Coatings

Two new 'dag' dispersions for industrial uses have been announced by Acheson Colloids Co., Port Huron, Mich. No. 213 contains colloidal graphite and No. 223 contains colloidal molybdenum disulfide. Both offer advantages of the epoxy resins as a base for dry, lubricating coatings. Films properly formed with these dispersions show excellent adhesion, wear-resistance and corrosion resistance; are unaffected by oils and solvents and may be used wherever temperatures do not exceed 500 F.

Dispersion No. 213, with solids content of 28.5 percent, can be sprayed full strength, forming films less than 0.5 mil thick. Dispersion No. 223 has a solids content of 63 percent by weight while consistency remains liquid. The dispersions are fully compatible and can be mixed to produce films containing both colloidal graphite and mlybdenum disulfide. **T-8-1152**



O-M CYLINDERS
(air • hydraulic)



Designed and engineered with the user in mind, O-M Cylinders embody every essential construction and mechanical feature to assure trouble-free performance and long service.

They are built of steel with bearing surfaces of bronze—precision machined with modern equipment.

Cylinder bores are honed to a fine finish, and the hi-tensile piston rods are polished to give long life and smooth performance.

Effective O-ring static seals are backed up to prevent extrusion under high pressures. All packings are self-adjusting and are carefully selected for proper usage.

A rigid inspection at the factory is your guarantee of peak performance.

O-M Cylinders fit where others won't because O-M special interlocking mechanism eliminates bulging tie rods and end caps.

Available in a full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. *14-day delivery on most sizes.*



Write today for FREE catalog and complete set of ½ and ¼-scale templates showing all cylinders and mounting brackets.

MAIL COUPON NOW!

ORTMAN-MILLER MACHINE CO.
1216 150th Street - Hammond, Ind.

☐ Please have representative call
☐ Please send latest catalog

Name _____
Company _____
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City _____ Zone ____ State _____

INDICATE A-8-115-2



In a four month period under actual competitive conditions one Diamond Wheel ground 36,976 pieces, while eight silicon carbide wheels ground a total 16,023 pieces.

RESULT— 1. Less cost per piece 2. Greater Production 3. Less down time.

See for yourself how

SECOMET DIAMOND WHEELS

can provide you with these plus values

Send for informative catalog #54 or contact us direct for information and assistance.



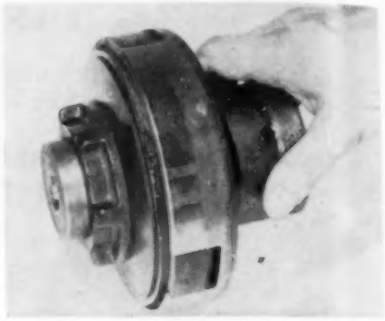
J. K. SMIT & SONS, INC.

MURRAY HILL, N. J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-116

Torque Limiter-Coupler

Overload protection for a variety of machinery drives with direct connected shafts is provided by the adjustable torque limiter-coupling units developed by Morse Chain Co., 7601 Central Ave., Detroit 10, Mich. The component combines features of an adjustable slip-clutch overload device with those of a flexible coupling. Compact in design, they are particularly suitable for motor drives with torque loads up to 260 feet/lb whether direct-coupled motor or motor and speed reducer combination. The torque limiter-coupling unit connects the motor shaft or the output shaft of the speed reducer with the primary drive shaft. It is so constructed that when overload conditions cause the torque setting to be exceeded, the friction disk breaks away from the driving plates and will then slip at from ⅓ to ½ the torque setting, rendering the drive inoperative and protecting the motor, machine and drive components. **T-8-1161**

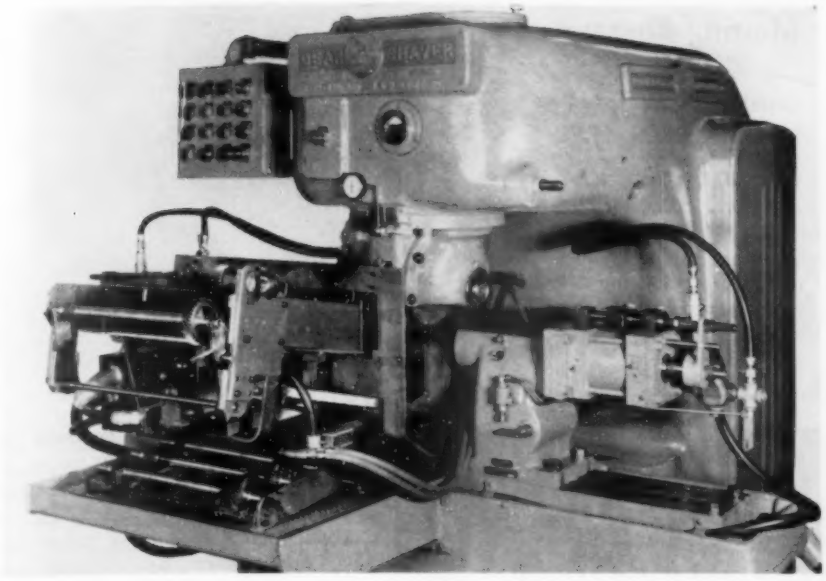


Super High-Speed End Mills

Super high-speed end mills, the Blackhawk line, have been developed by Metal Removal Co., 1546 N. Orleans St., Chicago 10, Ill., to prolong cutting efficiency when used on tough alloy steels and on abrasive ferrous and nonferrous materials. These end mills, which contain 5-percent vanadium, are said to be 100 to 300 percent more durable than those of regular high-speed steel.

After heat treating and a triple draw, vanadium carbides are dispersed providing a highly abrasive-resistant cutting edge, a good grain structure, and a mill with hardness of 66 to 67 Rockwell C without being overly brittle.

They are made in standard or special sizes; single or double end with 2, 3 or 4 straight or spiral flutes. **T-8-1162**



Automatic Loader for Gear Shavers

National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich., has developed a Red Ring automatic loader for handling long-shaft, unsymmetrical gears on standard rotary shaving machines. The unit includes a bulit-in gaging device, magazine feed, air- powered loading fingers and a discharge chute that feeds finish-shaved parts to undoading position in front of the operator.

A specially designed set of lever-type trip fingers in both input magazine and discharge chute keep the gears from touching each other and avoid the cocking parts that can result from the effect of the greater weight of one end of an unsymmetrical long-shaft gear.

When used in conjunction with a standard rotary gear shaving machine equipped with suitable controls and an air-powered tailstock, operation of the loader is completely automatic.

The loader illustrated handles a 14 diametral pitch, 3¼-in. OD, 1 in. wide gear having an integral shaft 17½ in. long at the rate of 180 gears an hour. The gear is 15⅜ in. from one end of the shaft, an extremely unsymmetrical design. It also is available in a variety of sizes designed particularly for long-shaft gear shaving. **T-8-1171**

Square with Dial Gage

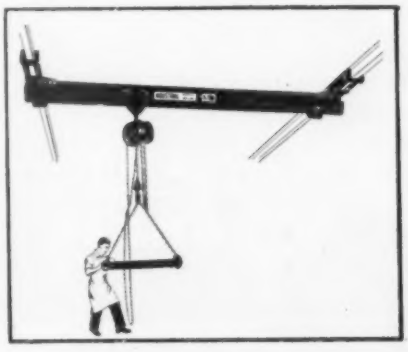
An engineer's dial gage square, for testing angles between finished plane surfaces incorporates a dial gage so that angular error may be read directly in 0.001 in. per foot; errors up to 0.030 in. per ft plus and minus may be read.

The square, designed by Acru Electric Tool Mfg. Co. Ltd., Chapel St., Stockport Rd., Levenshulme, Manchester 19, England, offers several advantages: it eliminates need for feeler gages; can always be reset to highest accuracy; can be used as a standard square gage. **T-8-1172**



Push-Type Cranes

An expanded line of push-type cranes is available in both light and heavy-duty models from Industrial Crane & Hoist Corp., 315 N. Ada St., Chicago 7, Ill. The lighter units are made in five different capacities, and the heavier ones in seven capacities. Capacities (for chain hoist applications) range



KEY UP *for Competition with* **SURE LOCK FIXTURE KEYS**

and Save **$9.92** *on Every Milling Fixture*



Eliminate Expensive Milled Keyways Entirely

SURE LOCK—the new, exclusive development in fixture keys, is meeting with wide success throughout the country. Some manufacturers are ordering them by the hundreds because...every fixture is immediately available to every machine regardless of T slot or size.

SURE LOCK KEYS are instantly interchangeable. Key can be locked from top or bottom as desired. When locked from the top automatic alignment is assured. Many other advantages. Write today for bulletin and prices. All sizes in stock.

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We offer over 500 Tool Components. Ask for 66 Pg. Complete Catalog

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INDICATE A-8-117

from 500 to 10,000 lb.

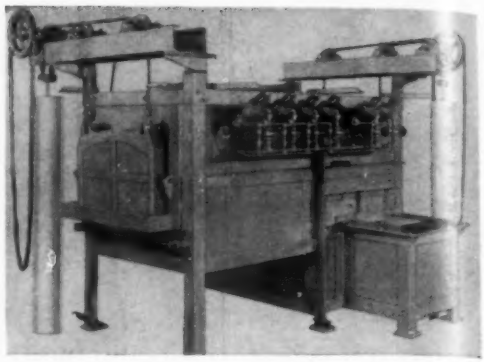
The cranes offer smooth performance, ease of operation due to precision manufactured end trucks. Underhung heavy-duty cranes are equipped with forged steel wheels with removable head axles.

The push-type cranes are available in various spans and can be equipped with hand operated or electric hoists.

Catalog PT-1253 gives details of construction and performance and complete lists of specifications and dimensions. **T-8-1181**

Melting Furnace

A dry hearth double-chamber melting furnace has been developed by Eclipse Fuel Engineering Co., 1002 Buchanan St., Rockford, Ill., for quality melting, die casting or permanent molding of aluminum parts requiring a minimum of porosity. Separate melting and holding baths are designed into a single unit, eliminating the necessity for containers. Among its advantages are high melting rate and uniform pouring temperature. Makers claim a 50-percent higher production per sq ft of floor space over that obtained with crucible furnaces, with fuel consumption per pound of metal lowered some 40 percent. The units are available in 12 standard sizes up to 2000 lb per hour capacity for gas, oil or combination gas-oil firing. **T-8-1182**



Faster ANGULAR SET-UPS
WITH GAUGE BLOCK ACCURACY
MAGNA-SINE

ON angular set-ups the Magna-Sine saves hours of set-up time, provides positive accuracy, holds work securely without distortion.

The Magna-Sine is a quality permanent-magnet chuck mounted on precision hardened and lapped hinged plates. A Table of Constants provided, quickly shows the standard gauge blocks to insert between the plates for any angle—single or compound. Set-ups to gauge block accuracy take minutes, not hours! When closed, the Magna-Sine is used as a conventional magnetic chuck. Thousands are in daily use.

Write for your free copy of the Magna-Sine Catalog which shows all styles and sizes . . . price list is included.

OMER E. *Robbins* COMPANY
DEPT. E-1, 24800 PLYMOUTH RD. • DETROIT 28, MICH.
Also producers of special gauges and fixtures



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-118

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Air Grinder

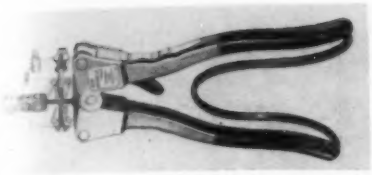
Precision pencil grinder for production work, combines qualities of high-speed, finger-tip control for difficult-to-reach work, and economy. The tool operates on air pressures of 50 lb or more. From this power the rotor, its only moving part, produces a spindle speed of 100,000 rpm.

Other features of the unit are its 5-oz weight, variable speed shut-off valve, and built-in safety guard, which protects both the operator's hands and the work's finish.

A specially designed oil filter and lubricator works to remove harmful dust and moisture from the air line and provide exact amount of lubrication. **T-8-1183**

Cold Welding Tool

A simple hand tool that works like pliers produces butt welds on wires of nonferrous metals. Only 14 inches in length it weighs but 5 lb. The tool, which may be used by unskilled workers, does not use heat, electricity or chemicals. The tools, the KB-14 and the KB-14B, produce quality welds at a rate faster than by conventional



welding. Equally satisfactory for wires of the same or dissimilar sizes, it will handle aluminum and copper and aluminum to copper wire in a range from 0.039 inch (#18 gage) up to but not including 0.063 inch (#14 gage, 0.064 inch nominal).

The KB-14 tool will handle copper wire from #14 to #11 gage, and aluminum and aluminum and copper wire from #14 to #8 gage.

More information on the tool is available from The Utica Drop Forge & Tool Corp., Utica 4, N. Y. **T-8-1191**

Smaller Air Compressor

A packaged air compressor in the 75-100 hp range that approaches the efficiency and economy of larger, more powerful, slow speed compressors, has been introduced by Ingersoll Rand Co., 11 Broadway, New York 4, N. Y. This unit, the PHE, is an opposed-cylinder, balanced design driven by a direct-connected, induction motor. Available arranged in single or multi-stages, the basic design is a two-stage unit for 80-125 psi with other cylinder arrangements available for higher pressures or for pumping vacuums. It requires very little floor space, a simple foundation and a minimum of piping and connections.

Design is so that the full floating aluminum bearings rotate slowly, thus taking the major thrust of each succeeding stroke on a different portion of the shell. All three main bearings are interchangeable.

Complete information is given in a brochure, Form 3155, available from the company. **T-8-1192**

Lubricant Carrier

Microfine solid lubricants, principally molybdenum-disulfide, dispersed in a propellant Fluron, has been compounded by The Alpha Corp., Greenwich, Conn., as a carrier for applying a controlled, uniform flow of molybdenum-disulfide to metal surfaces by spraying from a self-pressurized, aerosol-type container.

The compound, called Moly-Spray-



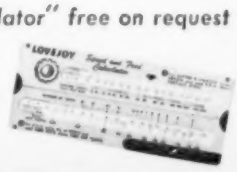
The
Complete
LOVEJOY LINE
of Modern Metal
Cutting Tools

The Lovejoy line of inserted-tooth type cutting tools has never been more complete — or offered so many features. Every tool has been designed to give maximum production with a minimum of down time for sharpening. Lovejoy tools feature the *exclusive* "Positive-Locking" device that assures rigidity even during heavy intermittent cuts — making them rugged as solid tools. Their housings — of husky forged steel — are designed for longest life.

Lovejoy H. S. S., Carbide and Cast Alloy Blades are interchangeable in the same housing and are stocked for immediate shipment.

For standard or special cutters, call on Lovejoy — suppliers to the world's leading manufacturers for over 35 years. Write today for Catalog No. 28 which describes the full line of Lovejoy tools.

"Speed & Feed Calculator" free on request



131 MAIN ST., SPRINGFIELD, VERMONT

LOVEJOY
TOOL COMPANY, INC.

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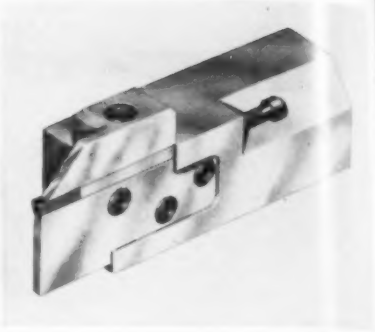
Kote, is noninflammable and may be sprayed on hot surfaces. It is noncorrosive and nontoxic and does not contain a resin binder.

The lubricant dries quickly leaving a solid, tenaciously adhering and long-lasting lubricating film, possessing chemical and thermal stability and a low coefficient of friction at extreme bearing pressures. Moly-Spray-Kote effectively prevents galling and seizing and is practical for use in hot forming operations as well as for reciprocating parts. **T-8-1201**

Clamp-On Cut-Off Tool

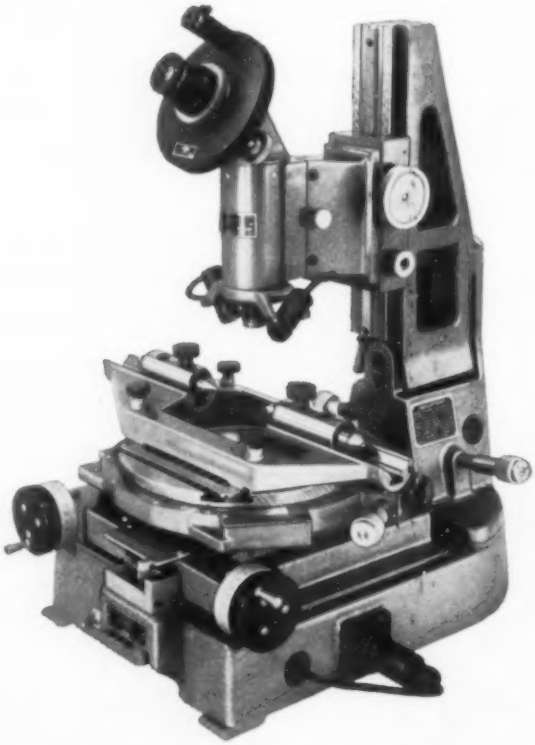
Fast, more economical carbide cutting is possible with the clamp-on tool for cut-off work introduced by The Portage Double Quick Tool Co., 1054 Sweitzer Ave., Akron 11, Ohio. Accuracy of the solid (not tipped) carbide cutting insert is assured by a patented V blade support. Always on center, the insert will not lead-off during cutting.

Insert change may be accomplished in only 15 seconds. The tool body need never be moved in the setup to replace a dull insert. An adjustable stop provides positive backing to prevent the insert from sliding back as well as giving a method of adjustment after the insert is reground. The interchangeable blade inserts are of a special molded carbide, butt welded to the steel tank.
the steel tank. **T-8-1202**



Gaertner OPTICAL INSTRUMENTATION

TO INSURE UNIFORM, ACCURATE PRODUCTION PARTS USE THE GAERTNER TOOLMAKERS' MICROSCOPE TO CHECK TOOLS, DIES AND GAGES



THE
GAERTNER TOOLMAKERS' MICROSCOPE
M2001ARS
2x4 inch Coordinate Measurement
Direct Reading to .0001 inches
Bulletin 147-50 tells the story in detail

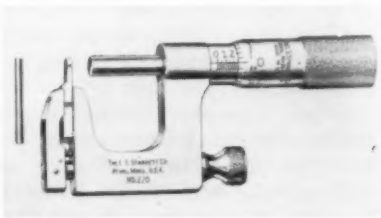
THE GAERTNER SCIENTIFIC CORPORATION

1241 Wrightwood Avenue • Chicago 14, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-120

Micrometers for Difficult Measurement

An unusually designed series of micrometers has been introduced by The L. S. Starrett Co., Athol, Mass. Identified as the Mul-T-Anvil micrometers, the series features interchangeable anvils offering the advantage of being able to make fast, accurate measurement in hard-to-reach spots. Anvils furnished with the device include a rod anvil (approximately 0.120 inch diameter) particularly useful for measuring from a hole to an edge; and a flat anvil (0.125 inch and 0.060 inch thick on opposite ends) practical for measuring distances from inside of slots and grooves to an edge.



Other anvils of various shapes can be made by anyone and need not necessarily be hardened for occasional special jobs.

Its vise-type frame holds the anvils which are locked in place quickly and rigidly by a single, simple lock screw adjustment. It also may be used as a height gage by removing the clamping vise jaw. Range covers 0 to 1 inch and reads in thousandths of an inch.

T-8-1203

Guide Bushings

Helical, spiral slots, instead of the conventional straight slots have been incorporated into the unusually designed carbide guide bushings introduced for Swiss type automatic screw



machines by Carl Hirschmann Co., Inc., Manhasset, N. Y.

These spirals not only provide better lubrication of the bar, but as they are inclined in the same direction as bar-rotation, they also assure a quicker disposal of any chips which might enter the bushing. For these reasons the stock may be held tighter without risk of seizing. **T-8-1211**

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Lever Punch and Shear

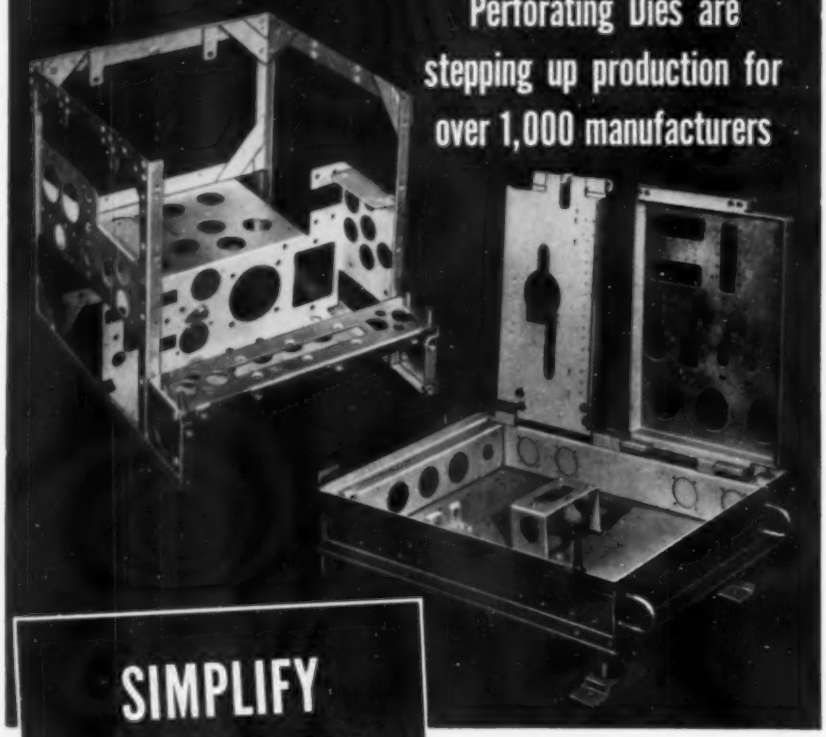
An extensive variety of work can be handled on the Niagara No. 5-24 deep throat lever punch and shear produced by Niagara Machine & Tool Works. With a 5-ton capacity and 24-inch throat, this machine permits accurate, smooth shearing in straight lines or intricate shapes as well as numerous



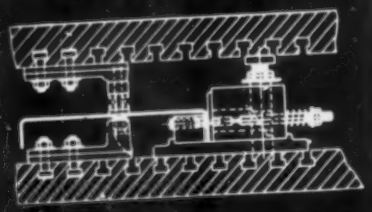


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-121

Whistler Adjustable and Magnetic Perforating Dies are stepping up production for over 1,000 manufacturers



SIMPLIFY COMPLICATED PIERCING OPERATIONS



Use this HU-50 90° Perforating Unit on the same job with other Whistler Dies ... often saves extra press operations.

USE WHISTLER Adjustable and Magnetic Dies for perforating, notching and slotting sheet metals ... fast, accurate and cost cutting. Complicated patterns can be set up quickly. Hole arrangements can be changed in the press...without waiting and at no extra cost. New HU-50 units, that pierce at 90° angle, can be used in conjunction with standard perforating equipment. Fewer press operations are necessary.

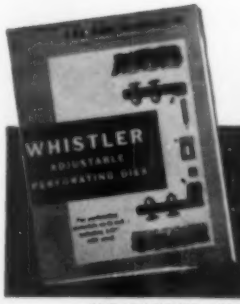
Re-use the same dies in different arrangements on many jobs. Punches and dies are interchangeable.

Whistler Adjustable Dies can be used in practically every type press. Standard sizes and shapes of punches and dies available up to 3 inches. Special sizes and shapes to order.

S. B. WHISTLER & SONS, Inc.

744 Military Road

Buffalo 23, New York





For prices and application data on this modern way to speed production and cut unit costs, write for these illustrated Whistler catalogs.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-122

types of punching and notching. It shears from front to back or left to right and slits sheets of infinite length up to 48 inches wide, down the center.

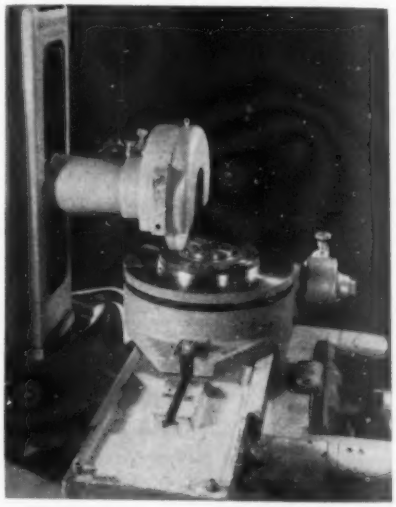
It may be equipped as a punch or shear or both, and is readily converted from one to the other. A large selection of punches and dies is available for simple or intricate holes, notching, corner trimming, combination trimming and cut-off operations. Narrow die shoes can be used for punching deep-legged channels and angles as well as wide die shoes for larger diameter and special shape dies.

Bulletin 79-B, describing this lever punch and shear, is available from the company, 683 Northland Ave., Buffalo 11, N. Y. **T-8-1221**

Air-Operated Rotary Table

Vulcan Tool Co., 7300 Lorain Ave., Dayton, Ohio, has introduced a rotary table for surface grinders, that uses regular air-line sources for power to attain variable speeds of 40 to 100 rpm.

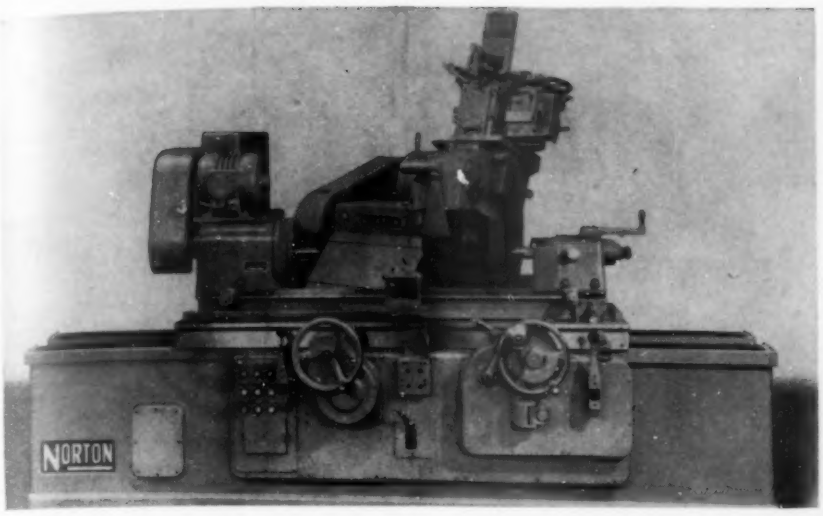
An inexpensive portable attachment,



the tables are available in 6 and 10-inch diameters. Since only the machine cross feed is used with these Vulcan rotary tables, machine error is reduced, while still producing precision grinding on tool or production items. **T-8-1222**

Angular Grinding Machine

Rapid simultaneous grinding of thrust surfaces and adjacent diameters in a single automatically controlled plunge grind is possible with the CV-4 angular wheel slide grinding machine introduced by Norton Co., Worcester 6,



Saw Blade Welder

Kasson Die & Motor Corp., 32-14 Northern Blvd., Long Island City 1, N. Y., the sales division for Brennen, Bucci & Weber, Inc., announces an improved Bren-Weld portable band saw blade welder that butt-welds all blades from 1/16 to ¾ in. The unit has a larger, heavy-duty transformer that assures a more uniform weld, and also now includes a larger grinding unit with a motor that is 50 percent more powerful than the earlier model. This built-in grinder is designed to remove flash from the weld. A double gage checks thickness of weld on flat saws. An all purpose unit, it is compact, fully automatic and portable. **T-8-1233**

Mass. In addition, the unit produces a concentric grain pattern in the finish of the shoulder or thrust surface ground. It also offers simplified operation and fast accurate sizing accomplished by a special feed mechanism that includes an index designed to permit settings for work diameter reduction in increments as fine as 0.0001 in. without visual attention. Both length and rate of automatic feed may be set quickly from normal operating position. The machine will take heavy work loads, and perform either roughing or fine finishing operations equally well.

It is available in 10 and 14-in. swings and in 36, 48 or 72 in. work lengths in either swing. **T-8-1231**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Stock Straightener

A variable speed stock straightener has been developed by Cooper Weymouth, Inc., 277 Noble Ave., Bridgeport 8, Conn., for use with presses, shears or slitters or alone, to straighten small parts and materials. When used in combination with feed-equipped presses, it automatically maintains stock in a free loop even though the press is run intermittently.

Available in models with five, seven or nine rolls, to handle stock from 2½ to 12 in. in width, the machine operates at controlled speeds from 10 to 50 fpm. Sturdy construction permits straightening of stock up to ⅛ in. in thickness.

Electrically operated and controlled, all models are complete units in themselves and come with an adjustable base. **T-8-1232**



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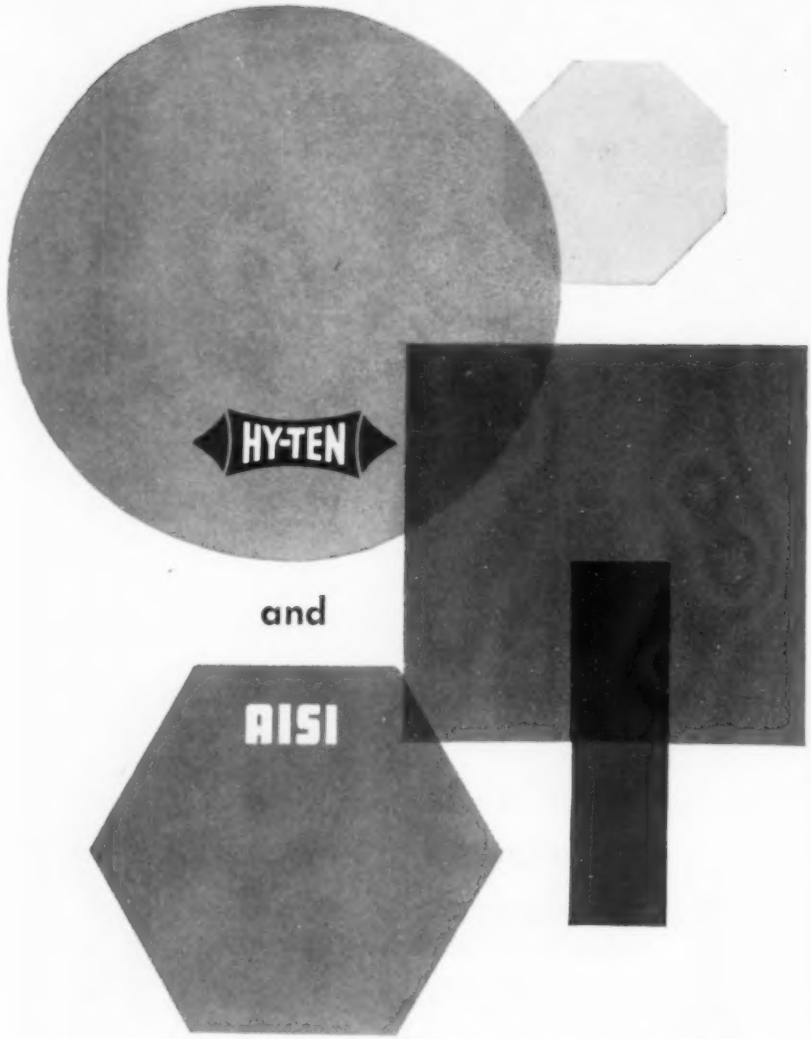
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abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Accuracy of Helical Bevel Gears

Except for information revealed in patent letters, no details have been available about the principles of the new gear cutter for milling of helical bevel gears of high accuracy. This machine had been on exhibit at the 1953 European Machine Tool Show, manufacturing teeth of precision gears with crowned flanks in their longitudinal direction. As usual, the teeth are slightly concave on the one side and slightly convex on the other, resulting in an area of contact of approximately elliptic shape. Thus, the teeth do not contact each other over the entire length but leave clearance at either end.

The new principle, as explained in an article by W. Krumme in No. 5 of *Werkstatt und Betrieb* makes possible varying the radii of curvature of the engaging flanks of the helical bevel gears to obtain any desired length of the elliptical area of contact. The center of the area of contact can be displaced in either direction with respect to the center line. Furthermore, it is possible to manufacture such gears where the contact areas of the two engaging flanks can be regulated independently of each other in order to locate the contact areas differently for forward and reverse rotation of the gears.

The author presents several diagrams of the kinematics involved in the new process. He indicates it is possible to vary the thickness of the teeth by a few adjustments of the cutter head to produce helical bevel gears where the axes of rotation do not coincide but are offset. Spiral bevel gears can also be manufactured for any desired spiral angle and of any desired backlash.

Electro-Erosive Metal Cutting

A summary of the present status of electro-erosive metal-cutting methods is given in the May 1954 issue of *Werkstatt und Betrieb* by Z. Baltz. He in-

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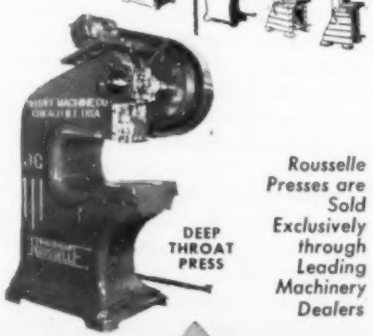


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dicates that three different methods are generally used now, namely, the electro-spark method, the electro-chemical and the electro-mechanical method. In the first method, direct current is used in conjunction with a condenser and a mechanical vibratory system for the tool whose frequency controls the electrical discharge and thus the oscillation of the tool during the metal-cutting process. Oil, water or gasoline is used as a coolant. In the second method, the combined effects of electrical discharges and of chemical deposits remove the metal with the aid of an electrolytic fluid made of silicates, borium, phosphor and other chlorides. There is neither a condenser nor a mechanical vibrator. In the third method, alternating current is used and the electrode (tool) contacts the work. Water, air and oil are used as coolants. Metal-cutting capacity is greatest in this case, requiring considerable quantities of electrode although the machining costs are said to be low.

By reversing the current it is possible to deposit metal instead of removing it. These processes are used to a considerable extent for grinding, drilling, heat treating, cutting and for removal of broken twist drills. The literature quoted includes: a publication by H. Stuehmke on "The Application of the Electro-Erosion Process in the Soviet Union and in Czechoslovakia," an article by H. Schlembach (Austria) on the application of the second method, a paper by H. Sohr on metal-cutting and one by H. Frantz on electro-erosive machining processes.

Surface Finish

A new method for measuring surface finish is described by W. Dreyhaupt in the June 1954 edition of *Werkstattstechnik und Maschinenbau*. Instead of determining the roughness of the surface by a stylist or other tracer methods the author suggests measuring surface finish by determining the portion of contact area obtained by placing a glass or crystal prism under pressure on the surface to be measured. The reflection of light gives a more accurate indication of the surface condition than mechanical methods. The author claims that this method is simple and can even be used when the workpiece is still on the machine.

The investigations carried out in connection with this development cover the relationship between roughness and contact area; the deformation that takes place at the peaks of the surface "mountains" when put under pressure; its effect on the measuring method and the differences obtained when using glass

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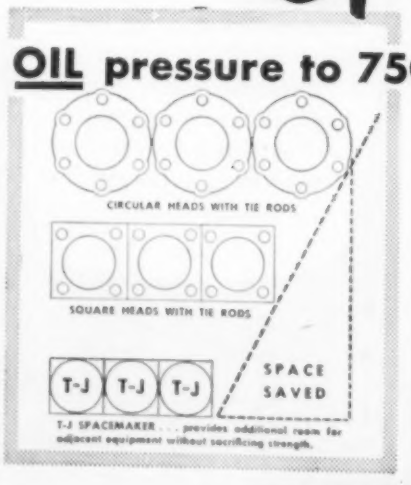
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prisms as against using diamond prisms. The latter are considerably more accurate and do not deflect when a load is applied.

Illustrations of the surface conditions of a roller bearing indicate that the contact area of the rollers were as high as 90 percent (that is a high accuracy rating) while that of the inner races was only 15 percent. The great difference in the two mating surfaces was taken as an indication that the rollers would wear rapidly; this conclusion was confirmed by tests. The author concludes by calling attention to the fact that under certain conditions it is even better to reduce the surface finish of the rollers because they would wear less when matched with a 15-percent surface on the races. Such combinations would give better service life and savings in the machining of the rollers would also be possible.

International Symposium

An international "Symposium on Engineering Dimensional Metrology" was recently held in England under the sponsorship of the National Physical Laboratory in cooperation with the Mechanical Engineering Research Laboratory covering the development of measuring methods, testing of machine tools, gear testing, education in measuring methods and surface testing.

Torenbohm, Sweden, reported on the wear of gages and means and ways for wear reduction in close cooperation of machine-shop men and research laboratories. G. Berndt, Germany, discussed the same topic while M. J. Turrettini, Switzerland, presented a paper on optical instruments for measuring of irregularly shaped workpieces by means of a new "shadowgraph."

K. Burger, Germany, contributed a discussion on methods and instruments for testing tapered thread gages, used particularly in oil-well-drilling industries. The United States was represented by a paper presented by L. Polk (Sheffield Corp.) on pneumatic gages and measuring instruments. R. Yribarren's (Switzerland) contribution was concerned with the application of pneumatic gages to dynamic testing. V. W. Stanley (England) showed lantern slides of a special lathe for cutting threads of highest accuracy, permitting up to 3000 threads per inch.

Standards for Surface Finish

A report on the correlation of surface finish and the dimensions of the workpiece has been published in the June, 1954 edition of *Werkstattstechnik and Maschinenbau,* prepared by the German Standards Association.

Various diagrams are included in-

...ng the surface finish obtained under different conditions and representing the roughness of a surface in relation to its purpose such as sliding surface, stationary surface, surface produced for appearance only and others.

The Committee preparing the report came to the conclusion that it is impossible to correlate roughness and dimensional tolerances and thus decided to correlate surface standards to the function of the respective surface.

...from Russian Publications

by R. Gibson
Asst. Professor of Economics
University of Illinois

Recent issues of leading Russian journals indicate that considerable progress is being made in the Soviet Union in the introduction of automatic and semiautomatic machine tools. For example, the January-February issue of *Planovoe Khoziastvo* (*Planned Economy*) notes a marked rise in labor productivity from the operation of 39 automatic machine-tool lines in the production of parts for automobiles, tractors, agricultural machines, etc. It is claimed that an automatic plant for the mass production of pistons for automobile engines is being operated in Moscow. It is said to employ only a few workers and to perform all processes automatically, "from the feeding of raw materials into the electric furnace to the packaging of the finished product." A photograph of one of these processes in the March, 1953 issue of *Soviet Union*, Russian equivalent of *Life*, shows parts being handled between operations by automation.

The May-June, 1953 issue of *Planned Economy* reveals that foundries are being mechanized for the casting of metal by modern line-production methods. Processes include centrifugal casting, casting under pressure and precision casting. Cupolas are charged mechanically, forms are molded and dried mechanically, and the hot metal is conveyed to the forms by mechanical means. The process of cleaning the castings is also mechanized.

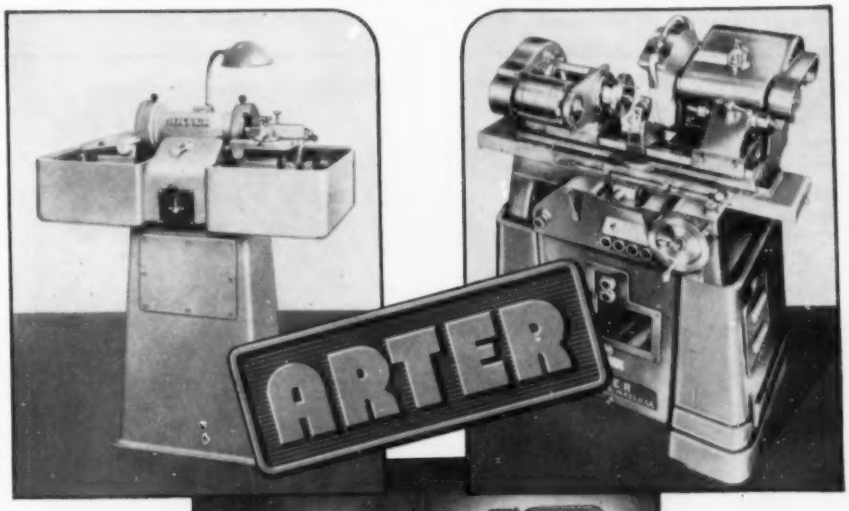
Heat treatment of machine parts is being automatized, metals are being tempered by high-frequency current devices, and in some shops forging and stamping are being carried on by continuous line production.

During the five-year plan which ends next year, the plan has been to design "more automatic regulators for electric, gas and oil furnaces, mechanisms for the control of inputs of fuel and air, spray burners for oil furnaces, and photoelectric pyrometers for measuring high temperatures."

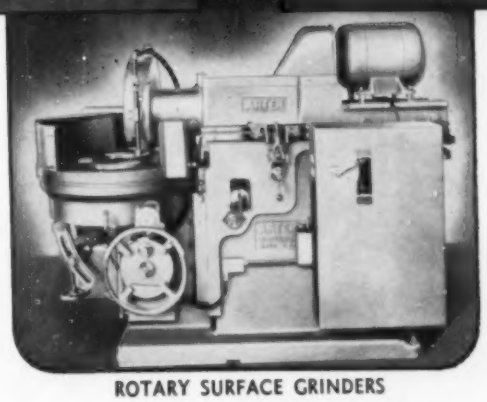
New equipment is being turned out for many industries by mass-production methods. Blast furnace equipment is said to be of the most modern design; fork-lift trucks are being used for materials handling; portable cranes are used in house building; and materials are loaded into freight cars on extension-type belt conveyors. *Planned Economy* for September-October, 1953 reports that electric coal cutters, conveyors and cutter loaders are in mass production.

Between 1949 and 1951 sixteen hundred new types of machines and mechanisms are reported to have been designed by the Soviet machine-building industry. In 1952 six hundred more were built and in 1953 seven hundred were manufactured. Reporting on results of the 1953 state plan for the national economy, *Pravda* reported on January 31, 1954, as translated in *Current Digest of the Soviet Press*, March 17, 1954, that 850,000 inventions and technical improvements were introduced during 1953 in Soviet industry, construction and transportation.

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Men at Work . . .

Stanley C. Amren has joined Cleveland Welding Co., subsidiary of American Machine & Foundry Co., as vice president and general manager. Since 1950 he has been manager of the Little Rock, Ark., plant of U. S. Time Corp. **David S. Meiklejohn,** who is a director and treasurer of AMF, now will act also as treasurer of Cleveland Welding.

Nolan E. McDonald has been named to head the recently established impact extrusion department of Magnesium Co. of America. Mr. McDonald was formerly technical assistant to the chief engineer of Reynolds Metals Co. where he had technical, supervisory and managerial duties in the Impact Extrusion and Guided Missile Divs.



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Organization changes at The Timken Roller Bearing Co. have resulted in promotions of three men. **Herchel M. Richey,** who previously was factory manager of the Bearing and Rock Bit Divs. now is general factory manager. **Henry A. Tobey,** who has been general superintendent of the Canton (Ohio) Bearing Div., has been made factory manager of the Canton and Gambrinus bearing factories. Former assistant chief inspector, **Wilbur L. Young,** has been promoted to the post of general superintendent of the Canton Bearing Div.

The Norma-Hoffman Bearing Corp. has revealed the appointment of **Harry Walker** as vice-president. Dr. Walker will be in charge of the newly formed Walker Div. which is located at the Stamford plant of the parent company.

Formerly assistant chief engineer of Arms Franklin Corp., **Arthur W. Johnson** has joined the engineering staff of the Rolling Mill Div. of E. W. Bliss Co. Mr. Johnson participated in the development of the Weld-A-Matic splicer recently acquired by Bliss.

Three additional divisions have been formed in the Brown & Sharpe Mfg. Co. manufacturing organization at its Promenade St. plant. **A. Dean Hunter,** formerly works superintendent, is now division superintendent of the Screw Machine Div. **Frank E. Manchester** was made division superintendent of a Central Services Div. which unites many of the internal service departments; and **Frank A. Benoit, Jr.** became division superintendent of the Foundry Div., which includes the Brown & Sharpe iron casting, cleaning and pattern making facilities.

Semon H. Stupakoff, formerly president of Stupakoff Ceramic and Mfg. Co., has been elected vice president of The Carborundum Co. The Stupakoff firm was acquired by Carborundum early this year and was recently made a division of Carborundum. In his new capacity, Mr. Stupakoff will continue to direct the activities of the division.



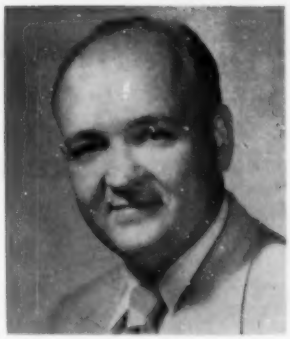
Edgar **W. Engle, former manager of product and process development engineering is now manager of cemented carbide products engineering for Carboloy Dept. of General Electric Co.**



Jacob J. Jaeger has been named to the newly created post of chief engineer, machinery engineering department of Pratt & Whitney. He has been assistant manager of Machinery engineering.



Graham B. Brown is now works manager of Tube Reducing Corp., supervising production, engineering and development phases, as well as start-up of the new Navy sponsored plant.



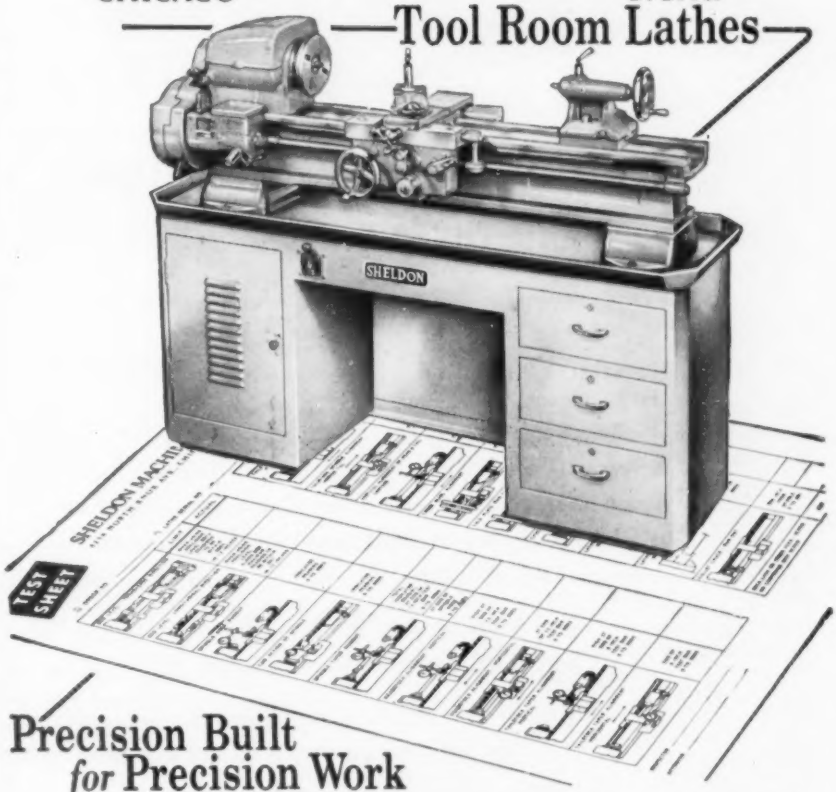
Paul H. Taylor was elected a director and vice president of Wales-Strippit Corp. in charge of the Research and Hydra Spring Divs. He previously was the director of patent and research.

J. E. Callahan, who until recently was acting manager of the Micarta Div. of Westinghouse Corp., has joined The Garrett Corp. In his new capacity, Mr. Callahan will be staff assistant to Frank W. Miles, vice-president of the company, and will assist him in the operation of recently acquired eastern companies.

Two appointments announced by the Nopak Div. of the Galland-Henning Mfg. Co. made **Robert W. Peterman** sales manager of the division, and **Robert J. Garnik** chief engineer. Mr. Peterman was formerly responsible for both product design and sales engineering, while Mr. Garnik will now be responsible for new product design and development as well as adaptation of Nopak products to special applications involving engineering changes which cannot be handled in the field.

American Machine & Foundry Co. also has revealed the appointment of **Col. Horace A. Quinn,** U.S.A. (Ret.) to the post of manager of its General Engineering Laboratories. Col. Quinn, who succeeds R. A. Kimes, now director of engineering of AMF's Electronics Div., had served with the U.S. Army for 23 years prior to 1946 and again from 1950 to 1954. He most recently had been chief of the Artillery Branch of the Research and Development Div., office of the Chief of Ordnance. Previously AMF had announced the appointment of **Brig. Gen. Oscar J. Gatchell,** U.S.A. (Ret.) to the position of technical assistant to the vice-president in charge of engineering. Brig. Gen. Gatchell, who formerly was professor and head of the Dept. of Mechanics of the United States Military Academy, has been a consultant to the company for the past year.

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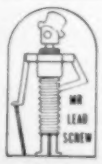
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Personnel appointments involving its sales, engineering and production departments have been announced by the Super Tool Co. **Milton J. Steffes**, formerly sales manager, was promoted to the position of chief engineer. In this capacity, he is to be in charge of all design, field engineering developments and new product engineering. **Kenneth R. Fisher** succeeds Mr. Steffes as sales manager, having served previously as carbide tool field sales representative handling the Super Tool line. **Louis B. Szal** who has been associated with Super since 1937, has been made works manager in charge of all production and shop personnel in both the Detroit and Elk Rapids plants.

New general manager of Worthington Corp.'s reorganized Vertical Turbine Pump Div. is **Fenmore E. Dunn**. His responsibilities will include product and application engineering as well as the manufacture and sales of the vertical turbine pumps produced at the Succasunna, N. J., and Denver, Colo., plants.

Ernest E. George, manager of design and application engineering at Carboloy Dept., General Electric Co., has now been named manager of magnetic products engineering.

The board of directors of Raymac Mfg. Co. recently appointed **Owen P. Langworthy** to the post of general manager of the company. Mr. Langworthy, who has had wide experience as a tool executive with various Detroit companies, succeeds L. A. Whitmore who has taken a leave of absence due to ill health.

Announcement of the appointment of **Berton E. Rogers** as general factory manager has been made by Vickers, Inc. Mr. Rogers, who was formerly vice-president in charge of manufacturing for Motor Products Corp., will be in charge of manufacturing and production activities at Vickers plants in Detroit, Omaha and Joplin, Mo.

Two other appointments at Vickers included the naming of **Philip H. Emrich** as manager of the Joplin, Mo., plant. Formerly manager of the Product Service Dept., he will now direct all activities of the Joplin plant where oil hydraulic pumps and controls are manufactured for the aircraft and mobile equipment industries. **Gordon Elliott,** who supervised plant construction and initial production at Joplin, has returned to his former capacity as manager of Vickers' expanded manufacturing plant at Omaha.

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TRADE LITERATURE

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Furnaces

Bulletin SC-164 covers complete line of furnaces for hardening and drawing or tempering operations; includes data on hardness from specific drawing temperatures for most common steels. Illustrated. Surface Combustion Corp., Toledo 1, Ohio. **L-8-1**

Materials Handling

Illustrated "Engineering and Application Data" booklet No. 2008-K contains pertinent information on overhead materials handling equipment such as various track drives, cranes, electrification, buckets, grabs, etc. Cleveland Tramrail Div., The Cleveland Crane & Engineering Co., Wickliffe, Ohio. **L-8-2**

Grinding Wheels

Twenty-eight page catalog 1748, "BN-BD-BFR-BF Reinforced Resinoid Products" contains typical application photographs, tables of wheel sizes, prices, operating speeds and other data. Numerous portable grinding operations are listed with recommended wheel specifications. Norton Co., Worcester, Mass. **L-8-3**

Lock Nuts

Illustrated 8-page catalog describes M-F Uni-Torque lock nut, explaining design of these reusable, stop type hexagon semi-finished lock nuts, outlining their engineering specifications, and suggesting applications. The MacLean-Fogg Lock Nut Co., Dept. X, 5535 N. Wolcott Ave., Chicago 40, Ill. **L-8-4**

Thermostat Metal

Six-page technical data sheet describing company's ASC-1 thermostat metal strip and fabricated bimetal elements offers tables, charts and formulas to assist users in design of thermostat metal elements. Thermostat Metal Div., American Silver Co., Inc., 36-07 Prince St., Flushing 54, N. Y. **L-8-5**

Multiple Vise

Illustrated brochure explains construction, operation and advantages of equalizing gang vise for holding more than one piece of work, equal or differing in size. Dery Tool and Die Co., Pine Meadow, Conn. **L-8-6**

Hydraulic Valves

Line of sub-plate mounted, solenoid operated hydraulic valves described in Catalog No. 260; JIC diagrams show flow operations under all types of action for each of 14 piston designs; cutaway drawings explain design details. Includes data and notes for individual circuit requirements. Rivett Lathe & Grinder, Inc., Brighton 35, Mass. **L-8-7**



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42" MODEL—Infinite variable feed. Automatic positioning. Table can be increased to 60" with sub-plates.

Just plug them into the nearest electric outlet—no setup time, no special equipment or adaptors required—no feed connection to machine with these completely self-contained motor driven Rotary Tables.

Use them on any boring or vertical milling machine for fast, accurate cycle milling and indexing . . . cam milling . . . production and face milling . . . any other special job needing an automatic revolving fixture. Send today for catalog that gives complete details.

ATTACH TO COMPANY LETTERHEAD

W. B. KNIGHT MACHINERY CO.
3918 West Pine Blvd. • St. Louis 8, Mo.

Send information on Power Feed Rotary Tables.

Name.....

Title.....

☐ Also send details on Knight Milling Machines.

W. B. KNIGHT MACHINERY CO.
3918 West Pine Blvd. • St. Louis 8, Mo.

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SEE THE DIFFERENCE



in HORTON CHUCKS

New plastic demonstrators show the advantages of Horton's Famous Five Extras.

1. Exclusive pilot hole construction
2. Chrome nickel steel scroll heat-treated to 40-45 Rockwell C
3. Exclusive replaceable pinion bushings
4. Self-contained operating screws
5. One-piece body construction

Now you can SEE these built-in extras in actual operation. Ask your Horton Distributor NOW!

HORTON CHUCK
Windsor Locks, Conn.

INDICATE A-8-132-1

Surface Grinders

Illustrated brochure gives full details on company's Type C hydraulic surface grinders discussing important features of construction and operation; includes diagrams and specification charts. The Thompson Grinder Co., Springfield, Ohio. **L-8-8**

Face, End Mills

Eight-page brochure cover details of two series (fine and extra fine) recently added to Kroslok line of face milling cutters and shell end mills. Well illustrated to show main features and uses. Includes technical data, specification diagrams and charts. The Motch & Merryweather Machinery Co., Cutting Tool Mfg. Div., 1250 E. 222nd St., Cleveland 17, Ohio. **L-8-9**

Gages

Several newly designed dial gages including Paralloc type snap gages, both direct and lever types, Dializers, bore and throat gages presented in illustrated brochure outlining special features and advantages of each. Standard Gage Co., Inc., Poughkeepsie, N. Y. **L-8-10**

Duplicating Equipment

"Quick Facts to aid in selecting Die-Less Duplicating Equipment" describes company's benders, rod-parters, punch presses, shears, brakes, notchers and rollers; includes specifications and capacities for each type equipment and outlines features. O'Neil-Irwin Mfg. Co., 830 Eighth Ave., Lake City, Minn. **L-8-11**

Bench Press

Company's Model 500 bench press that operates off shop air lines described in folder emphasizing advantages of its use. The Alliance Mfg. Co., Alliance, Ohio. **L-8-12**

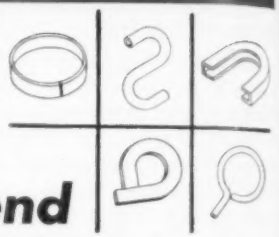
Twist Drill Grinder

The Cawi-Spiral twist drill grinding machine for drills from 1/16 to 1 in. presented in detail in illustrated folder explaining various uses, applications and advantages. Represented in U.S.A. by Kurt Orban Co., Inc., 205 E. 42nd St., New York, N. Y. **L-8-13**

Form Relieving Fixture

Eight-page bulletin explains operation of universal form relieving fixture stressing important design features. Well illustrated with drawings and photos. Grinder Div., Royal Oak Tool & Machine Co., 29800 Stephenson Hwy., Royal Oak, Mich. **L-8-14**





Bend a Variety of Materials

Accurately, Easily, Quickly with a DI-ACRO* BENDER

Simple and complex bends can be formed and duplicated in many ductile materials with a versatile Di-Acro Bender. Bending capacity of the five hand operated models ranges from 1/16" wire to 1" round mild steel bar. Many accessories are available for bending various materials and shapes. The Di-Acro Bender can be delivered completely tooled for most forming requirements in solid materials and tubing.

*Pronounced Die-ack-ro



DI-ACRO HYDRA-POWER BENDER

A universal hydraulically operated bending machine that is equally as flexible as hand operated machine. Di-Acro Hydra-Power Benders are especially designed for those long runs and heavy bending operations which are impractical for manually operated equipment.



Creators of "DIE-LESS DUPLICATING"

WANT MORE INFORMATION?
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Gives complete details on hand and power operated Di-Acro Benders, Brakes, Notchers, Press Brakes, Punch Presses, Rod Parters, Rollers, Shears and Spring Winders. Send for your copy today—there's no obligation.

O'NEIL-IRWIN MFG. CO.
375 8th Avenue
Lake City, Minn.

di-acro PRECISION METALWORKING MACHINES

INDICATE A-8-132-2

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-8-139	Adamas Carbide Corp.	**Carbide Tools**—New catalog AT53-C describes the 11 styles of tools and discusses quality standards. (Page 139)
A-8-216	Allegheny Ludlum Steel Corp.	**Tool Steels**—Concise 4-page folder gives handling and shop treatment details of Saratoga steels. Also included is certified laboratory information on physical characteristics and complete data on forging, annealing, hardening, tempering, etc. (Page 216)
A-8-262-3	American Machine & Foundry Co.	**Drill Chucks**—Folder W-50 tells how "Quick Chuck" cuts machine time and saves tools. (Page 262)
A-8-184	American MonoRail Co.	**Overhead Handling Equipment**—Bulletin C-1 illustrates and describes many successful monorail installations. (Page 184)
A-8-12	The American Tool Works Co.	**Radial Drill Press**—Illustrated bulletin No. 327 discusses versatility and quality of "American" Hole Wizard Radial drill press. (Page 12)
A-8-158	Anker-Holth Div. The Wellman Engineering Co.	**Air and Hydraulic Cylinders**—A bulletin gives complete line of Anker-Holth products. (Page 158)
A-8-171	W. F. & John Barnes Co.	**Special Machinery**—Booklet "Coordinated Machine Engineering" describes modern machines and mass production techniques. (Pages 170-171)
A-8-232	Beaver Tool and Engineering Corp.	**Toolholders and Adapters**—Catalog 52 completely describes the various types of products made by Beaver Engineering. (Page 232)
A-8-241	The Bodine Corp.	**Multiple-spindle Machines**—Brochure "Bodine Presents 12 Typical Case Histories" discusses how various users adapted these machines to their needs. (Page 241)
A-8-203	Buhr Machine Tool Co.	**Special Machines**—Forty-eight page catalog tells of the advantages of the Buhr machine and points out standard Buhr features. (Page 203)
A-8-247	Campbell Machine Div. American Chain & Cable	**Abrasive Cutting Machines**—Bulletin DH-301 gives specifications for and describes the advantages of Campbell dry abrasive cutter. (Page 247)
A-8-25	The Cincinnati Shaper Co.	**Press Brakes**—Seventy-two-page catalog describes the bending qualities of Cincinnati press brakes. (Pages 24-25)
A-8-243	Clearing Machine Corp.	**Inclinable Presses**—Catalog gives complete size and tonnage specifications of Clearing O.B.I.'s. (Page 243)
A-8-223	Colonial Broach Co.	**Broaching Machines**—A bulletin 877 gives the complete line of Colonial broaching machines. (Page 223)
A-8-242-3	Colonial Bushings Inc.	**Drill Jig Bushings**—Data for designing drill jig bushings are contained in a "Flip-a-Page" catalog. (Page 242)
A-8-157	Dearborn Gage Co.	**Gage Blocks**—Ellstrom Standards Catalog contains complete specifications and prices on the entire Ellstrom line and describes inspection service and trade-in plan. (Page 157)
A-8-121	Eastman Kodak Co.	**High-Speed Cameras**—"High-Speed Motion Picture Making in Industry" tells how the high-speed camera aids industry. (Page 121)
A-8-183	Edlund Machinery Co.	**Drilling Machines**—Bulletin 140 describes the Edlund 2F variable speed drilling and tapping machine. (Page 183)
A-8-267	Ex-Cell-O Corp.	**Drill Jig Bushings**—Illustrated catalog describes the six principal types of A.S.A. standard bushings and tells how to use them. Also gives purchase and design suggestions. (Page IBC)
A-8-23	Frauenthal Div. Kaydon Engineering Corp.	**Multiple-Head Grinders**—Bulletin 301 discusses features and advantages of the series 3100 grinder. (Pages 22-23)
A-8-120	The Gaertner Scientific Corp.	**Toolmakers' Microscope**—Bulletin 147-50 tells the story in detail. (Page 120)
A-8-143	The Gairing Tool Co.	**Spade and Core Drills**—Catalog contains price list and gives features of Gairing tools. (Page 143)
A-8-19	Gisholt Machine Co.	**Hydraulic Automatic Lathe**—Twenty-eight examples of quality production of both simple and complex parts are illustrated in catalog No. 12. (Pages 17-20)
A-8-140	Gorham Tool Co.	**End Mills and Milling Cutters**—120-page catalog shows entire line, contains valuable engineering information. (Page 140)

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THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-8-210	Greenlee Bros. & Co.	**Interchangeable Toolholders**—20-page booklet describes and illustrates features of toolholders for automatics. (Page 210)
A-8-141	Handy & Harman	**Metal-Joining Equipment**—Illustrated Bulletin 20 includes useful pointers about joint design and fast, low-cost production methods. (Page 141)
A-8-5	Hardinge Bros., Inc.	**Collets**—Bulletin 50 discusses the features and advantages of Hardinge collets. (Page 5)
A-8-179	The Hydraulic Press Mfg. Co.	**Air and Hydraulic Cylinders**—Twenty-eight-page condensed catalog covers a complete H-P-M line of hydraulic components. (Page 179)
A-8-251	Kearney & Trecker Corp.	**Special Machinery**—A booklet "Doorway to a Proven Method for Solving Big or Small Metalworking Problems" tells of the application of special machines to specific jobs. (Page 251)
A-8-196	Keller Tool Co.	**Air Tools**—Catalog 70 gives complete details and information concerning Keller air tools. (Page 196)
A-8-153	Lehmann Boring Tool Div. Novo Engine Co.	**Boring Tools**—Advantages of Lehmann boring tools are given in Catalog BT-12. (Page 153)
A-8-192-4	Louis Levin & Son, Inc.	**Bench Lathes**—Catalog L describes lathes for tool work, second operations, turrets and full line of accessories. (Page 192)
A-8-119	Lovejoy Tool Co., Inc.	**Cutting Tools and Holders**—Catalog 28 describes the full line of Lovejoy tools. (Page 119)
A-8-211	Miller Fluid Power Co.	**Air and Hydraulic Cylinders**—Bulletins A-105 and H-104 discuss applications of Miller Air and Hydraulic Cylinders. (Page 211)
A-8-228	National Broach & Machine Co.	**Gear Shaving Machines**—Instruction feature and cost savings are discussed in Bulletin S-53-7. (Page 228)
A-8-152-2	Newcomer Products Co., Inc.	**Toolholders and Carbide Inserts**—Catalog 109-54 describes the various carbide insert shapes and tells how they are held by special toolholders. (Page 152)
A-8-195	Niagara Machine & Tool Works	**Presses**—Bulletin 64-H previews new line of straight side presses. (Pages 194-195)
A-8-8	C. A. Norgren Co.	**Spray Lubrication Systems**—Norgren blueprint SL-2 points out improved cutting possible with a Spray-Lube system. (Page 8)
A-8-34	The Ohio Crankshaft Co.	**Induction Welding Equipment**—Bulletin discusses production increase and fuel savings with Tocco induction welding equipment. (Page 34)
A-8-132-2	O'Neil-Irwin Mfg. Co.	**Bending Machinery**—Thirty-two-page catalog gives details on hand and power-operated benders, brakes, notchers, press brakes, punch presses, rod partners, rollers, shears and springswinders. (Page 132)
A-8-115-2	Ortman-Miller Machine Co.	**Air and Hydraulic Cylinders**—Catalog gives features of O-M cylinders. Included are set of ½ and ¼-scale templates showing all cylinders and mounting brackets. (Page 115)
A-8-106	The Parker Stamp Works, Inc.	**Marking Dies and Stamps**—Illustrated thirty-six-page catalog tells of the flexibility of Parker's facilities. (Page 106)
A-8-193	Rivett Lathe & Grinder, Inc.	**Air and Hydraulic Cylinders**—Catalog section 104 gives nomenclature and advantages of Rivett cylinders. (Page 193)
A-8-118	Omer E. Robbins Co.	**Sine Grinder Chucks**—Magna-Sine catalog gives styles, sizes and price lists of Magna-Sine chucks. (Page 118)
A-8-268	Sheffield Corp.	**Visual Gages**—Catalog 500-54 tells how Sheffield gages can be suited to specific requirements. (Page BC)
A-8-116	J. K. Smit & Sons, Inc.	**Diamond Impregnated Wheels**—Catalog 54 points out the advantages of diamond wheels. (Page 116)
A-8-117	Standard Parts Co.	**Fixture Keys**—Sixty-six-page catalog offers over 500 tool components. (Page 117)
A-8-126	The Tomkins-Johnson Co.	**Air and Hydraulic Cylinders**—Bulletin Sm-454-2 discusses the design and performance of spacemaker cylinders. (Page 126)
A-8-176	The Torrington Co.	**Rotary Swaging Machines**—Booklet on swaging includes complete descriptions of Torrington rotary swagers. (Page 176)
A-8-9	The Wade Tool Co.	**Lathes**—Illustrated brochure discusses the Wade No. 8A lathe. (Page 9)
A-8-214	Wales-Strippit Corp.	**Punching and Notching Equipment**—Color illustrated catalog CJ discusses time and cost-saving methods. (Page 214)

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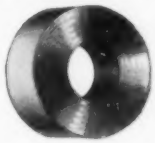
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for AUTOMATION on slitter, shear or punch press

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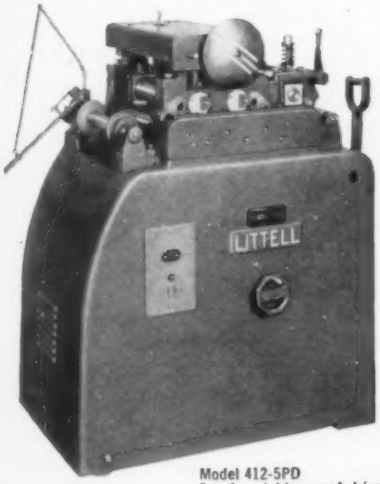


converted to workable

flat stock

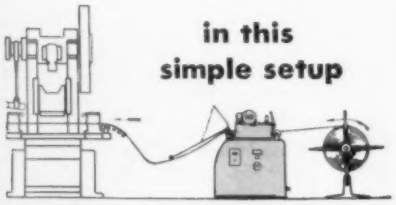


by a LITTELL Variable Speed Straightener



Model 412-5PD
5 to 1 variable speed drive
Straightens steel stock up to .125" thick x 12" wide.

in this simple setup



Coil stock comes out of a Littell Straightener commercially *flat*, in perfect condition for accurate, automatic, high speed work on punch press, shear or slitter. The right straightener for your requirements is in the complete Littell line. *Write for the Littell Straightener Catalog*

F. J. LITTELL MACHINE CO.

4199 N. Ravenswood Ave., Chicago 13

INDICATE A-8-135-1

Nylon Gears

"Injection Molded Nylon Gears" are discussed from a design and tooling standpoint; includes details on tooling, costs, design recommendations; also lists answers to common questions about nylon. Westplex Corp., Rochester 14, N. Y. **L-8-15**

Honing

Twelve-page booklet discusses Sunnen honing machines and their uses, working principles and exclusive features. Condensed case history information gives production data on numerous honing applications. Sunnen Products Co., 7910 Manchester, St. Louis 17, Mo. **L-8-16**

Air Power

Advantages of air power for faster, economical production emphasized in 52-page Industrial Air Power catalog. Includes many new products suitable for use in forming automatic or semi-automatic production machines. Illustrated. Mead Specialties Co., Catalog Dept. 74, 4114 No. Knox Ave., Chicago 41, Ill. **L-8-17**

Grinding Optics

Descriptions, specifications and dimensional drawings included in folder on steel bonded diamond wheels for grinding optics. Includes prices. Precision Diamond Tool Co., Elgin, Ill. **L-8-18**

Milling Machine

Brochure introduces Model 66 Rigidmil milling machines, describing important features and advantages; and giving spindle speeds, table feeds and table cycles. Also illustrates some typical uses. Sundstrand Machine Tool Co., Rockford, Ill. **L-8-19**

Measurement Recording

Extensively illustrated with photos and drawings, brochure deals with the Probograph, an automatic recording precision measuring instrument; describes its construction, use, details of operation, advantages and characteristics. The Warner & Swasey Research Corp., 34 W. 33rd St., New York 1, N. Y. **L-8-20**

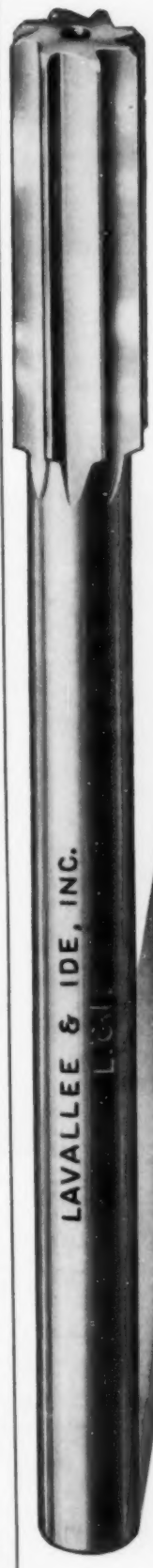
Automatic Drill Unit

Illustrated brochure presents important features of self-contained automatic drill unit and its various production advantages. Gives complete specifications, includes price sheet. The Dumore Co., Racine, Wis. **L-8-21**

for Quality Reamers

LI

stands alone



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The Reamer Specialists

LAVALLEE & IDE, INC.
CHICOPEE, MASS.

INDICATE A-8-135-2

Technical Shorts...

Grinder Specifications

STANDARD designations that have been created to provide the basis for understanding so that the builder and the purchaser may carry on transactions regarding grinding machines more easily and more effectively have just recently been published by the American Standards Association. The specifications are known formally as the "American Standard Designation and Working Ranges for Grinding Machines of the Horizontal Reciprocation Table Type and of Plain Cylindrical Grinding Machines." In situations where they are applied they should enable a foreman to know that he can assign a machine a certain size workpiece and be positive of how wide a surface the machine will grind upon that workpiece.

John Haycock, chairman of the committee which developed the standard, emphasized that the designations affect only the basic working ranges of machines. Manufacturers are left completely free in regard to details of individual design, with no limit intended to efforts to improve capacity or precision of machine tools. They do not fix speeds, durability, rigidity nor elements that facilitate machine tool operation.

Wheel sleeve diameters, widths and lengths of working surfaces, and the maximums of longitudinal, transverse and vertical travel are specified for the reciprocating table type machines. For plain cylindrical type grinding machines, the length and nominal length and swing of the cylinder are specified.

* * *

Lab Work at Wisconsin

VARIOUS LABORATORIES of the University of Wisconsin's College of Engineering are engrossed in a total of 176 technical research projects supported by funds amounting to more than $400,000. Fifteen of the projects are being carried on for the federal government at a cost of $160,000, nearly double the amount of federal research at this college of engineering a year ago.

* * *

High Strength Bonding

METAL-TO-METAL and metal-to-plastic bonding may be accomplished with improved results with the two new structural adhesives for these purposes recently developed by Rubber and Asbestos Corp. One offers unusually high strengths at normal temperatures, while the other permits very high flexibility at high temperatures. Although developed originally for aircraft structural applications, both appear to suggest broad applicability to industrial production uses.

The formulation for normal temperature use, Bondmaster M615, yields shear strengths, (under the Air Force tensile shear method) up to 3500 psi with accompanying peel strength (NEMA method) up to 19 lb, plus unusual impact strength.

Bondmaster M616, the second formulation, provides shear strengths up to 3000 psi at 180 F, while maintaining excellent flexibility. In a specific example, strips of aluminum bonded to aluminum, could be bent to a half circle while maintaining 1500 psi strength after being subjected to temperatures in excess of 300 F.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-136

FACILITIES AVAILABLE for metals research at Armour Research Foundation of the Illinois Institute of Technology have been summarized in a 14-page brochure. Personnel, their experience and the services offered by the metals research staff are covered in the booklet. It also outlines the facilities offered in the fields of metallurgy—including powder, applied, extraction, mechanical, nonferrous and physical metallurgy—as well as metallography, electro-chemistry, foundry and steelmaking and welding.

Outline Plan for Research

Details of the Armour Plan, a cooperative method of dealing with research problems are presented in a chart form to demonstrate how the plan works for the sponsor of a research project in these fields.

Copies are available gratis from the Metals Research Dept. of Armour, 3350 S. Federal St., Chicago 16, Ill.

* * *

LUBRICATION even at temperatures as low as 100 degrees below zero has been made feasible through a new development of an oil by Elgin National Watch Co. The Elgin scientists anticipate elimination of one of the prime obstacles to successful arctic military operations to be an outcome of this oil discovery.

Oil Defies Arctic Cold

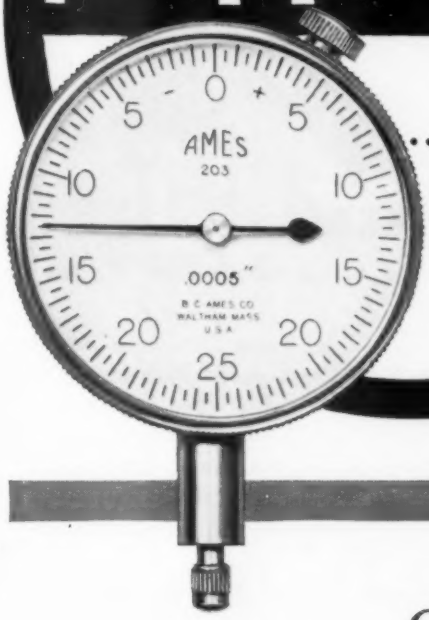
* * *

QUESTIONS surrounding the problem of when should an industrial or commercial electrical distribution system be modernized are treated in "Chain Reaction," a film released by Westinghous Electric Corp. Primarily it deals with the practical aspect of how to achieve lower unit cost production in manufacturing and yet maintain competitive facilities in commercial buildings. The film offers its reasoning through depicting an imaginary though typical tool works president who faces the alternative of either retaining a static position because of slow business, or modernizing the electrical distribution system to cut losses due to breakdowns and resulting high maintenance. The presentation emphasizes the chain reaction effect on other businesses resulting from his decision to modernize.

Film Urges Modernization

The film is a combination of color movies interspersed with slides to permit a narrator to give a detailed explanation of certain points.

AMES



...the preferred Dial Indicators

One of America's largest and most famous mass-producers recently chose Ames as preferred source of supply for indicator gauges.

The reasons behind this decision are the very reasons why *you* should standardize on Ames dial indicators and dial gauges:—the Ames "Hundred Series" indicators available in four sizes, fit every measuring requirement; they are *accurate, sensitive,* low in friction, yet are *rugged* and *tough*—give *more* on-the-job time. All Ames products embody latest design and highest-quality materials; they are manufactured by methods and machines that are *exclusive* with B. C. Ames Co.



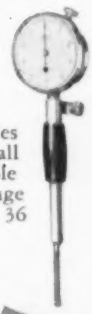
Ames Dial Depth Gauge No. 11C



Ames Dial Micrometer No. 517

Ames Amplifying Dial Comparator No. 26





Ames Small Hole Gauge No. 36

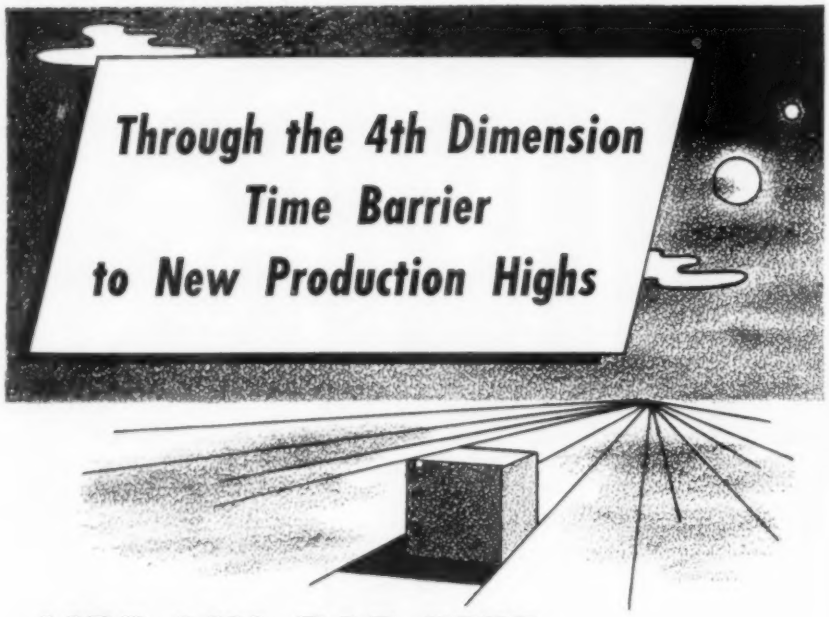


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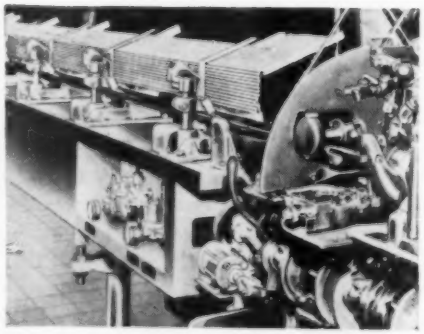
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gears machine production to the steady flow of Time

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Time losses account for the enormous differences in output among workmen. By eliminating these losses automatically, the Lipe AML Bar Feed boosts overall production from 30% to 100%. That's because stock is fed to the machine independent of the operator. Constant pressure behind the stock assures uniform speed of feed. No feed fingers to fail or mar stock. No multiple feed-outs, even on the longest pieces.



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good reading

FUNDAMENTALS OF THE WORKING OF METALS *by E. Sachs. Published by Interscience Publishers, Inc., 250 5th Ave., New York, N. Y. Price $4.75. 158 pp.*

Various chapters of this book present a basic description of phenomena which determine the performance of metallic materials on mechanical workings.

An attempt is made to present an elementary discussion of such basic facts which determine the success or failure of forming operations in metals. Processing into simple shapes, such as plate, sheet, strip, billets, bar, rod, wire and tube is also treated.

INDUSTRIAL PIPING *by Charles T. Littleton. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. 394 pp.*

No attempt is made in this book to discuss the theories of hydraulics, thermal expansion and radiation. Practical methods commonly in use for solving such problems as sizing of pipes and determining pressure drop are presented.

Data found in catalogs are given so that a rational choice between materials may be made. A special chapter on estimating piping costs is included.

INDUCTION AND DIELECTRIC HEATING *by J. W. Cable. Published by Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y. Price $2.50. 576 pp.*

An organized treatment of recent uses of applications of high-frequency heating is presented in this book. It is divided into two sections: induction and dielectric heating.

Each section begins with fundamental theory of high-frequency magnetic and dielectric fields, and operating principles of equipment used as sources of electrical energy. Coil and electro design are covered fully, together with the consumption of mechanical jigs and fixtures and work handling methods.

Subsequent chapters are divided into forging, belting, brazing, hardening and other metalworking operations, plastics, woodworking and food processing.

MECHANICS OF MATERIALS *by T. G. Lawson and W. J. Cox. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $5.75. 411 pp.*

Presented in this textbook is a discussion of the fundamental principles of machine and structural design. The physical behavior of stressed bodies in the light of practical problems confronting engineers is covered.

This third edition differs from earlier ones by an increased emphasis on the statics of stress determination and the postponement of material on stresses determined by deformation.

MAGNETIC COOLING *by C. G. E. Garrett. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $4.50. 110 pp.*

A balanced review of work done in the field of magnetic cooling in England, Holland and the United States is presented in this book. Particular attention is given to progress of the last ten years. An attempt is made to bridge the gap between physicists and chemists working in this field.

The author emphasizes the quantum theory, thermodynamics, paramagnetic resonance, relazation effects and the theory of cooperative phenomena. Also discussed are possible applications of the technique of magnetic cooling to continuous refrigeration at very low temperatures and the study of nuclear disintegrations.

JET AIRCRAFT SIMPLIFIED *by Charles E. Chappel. Published by Aero Publishers, Inc., 2162 Sunset Blvd., Los Angeles 26, Calif. Price $2.75. 176 pp.*

This book explains the basic principles and practical applications of aircraft jet propulsion. Among the subjects discussed and illustrated are the discovery of jet propulsion, simple examples of jet propulsion, the athodyd, the pulsejet, the turbojet, the turboprop, typical turbojets in production, turbojet powered aircraft, guided missiles, pilotless and rocket-powered aircraft.

ALUMINUM HEAT TREATING. *Published by Reynolds Metals Co., Louisville 1, Ky. Price $1.00. 118 pp.*

Metallurgy involved in the heat treatment of aluminum alloys is covered in a nontechnical manner in this book. Separate chapters are devoted to annealing, stabilizing, solution heat treatment and precipitation hardening. A special feature discusses heat treating cast aluminum products. Micrographs and a glossary are included.



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Who's Meeting - and Where

Aug. 23-Sept. 3. Massachusetts Institute of Technology. Intensive course on Casting of Light Metals; covering metallurgy, heat treatment, welding, behavior and control of gases in metals and other pertinent points.

Second course, on Automatic Control of Machine Tools, to be held during the same period, will cover systems and components, programming techniques, practical procedures and machine aids. For details and application blanks for either course, write Summer Session Office, Room 7-103, M.I.T., Cambridge 39, Mass.

Sept. 1-16. International Electrotechnical Commission. Golden Jubilee Meeting. University of Pennsylvania, Philadelphia. Direct correspondence to U.S. National Committee, American Standards Assn., 70 E. 45th St., New York 17, N. Y.

Sept. 5-8. Pressed Metal Institute. Annual fall meeting. Manoir Richelieu Hotel, Murray Bay, Quebec, Canada. Direct inquiries to Institute offices, 2860 E. 130th St., Cleveland, Ohio.

Sept. 8-10. American Society of Mechanical Engineers. Fall meeting. Hotel Schroeder, Milwaukee, Wis. Contact society office, 29 W. 39th St., New York 18, N. Y. for particulars.

Sept. 8-10. Porcelain Enamel Institute, Inc. Forum on shop practice. University of Illinois, Urbana, Ill. For details, write Institute office, DuPont Circle Bldg., Washington 6, D. C.

Sept. 12-16. American Institute of Chemical Engineers. National meeting, Colorado Hotel, Glenwood Springs, Colo. Get more information from Institute headquarters, 120 E. 41st St., New York, N. Y.

Sept. 12-17. American Chemical Society. Fall meeting, New York. For details contact society office, 1155 16th St., N. W., Washington 6, D. C.

Sept. 13-24. American Society of Mechanical Engineers. Joint IRD and ISA conference, Convention Hall, Philadelphia, Pa. Write to society headquarters, 29 W. 39th St., New York, N. Y. for more facts.

Sept. 13-24. Instrument Society of America. First International Instrument Congress and Exposition, Convention Hall and Commercial Museum, Philadelphia, Pa. More details are available from society office, 1318 Allegheny Ave., Pittsburgh, Pa.

Sept. 14-23. Fourth European Machine Tool Exhibition, Milan, Italy. For all details concerning the show, write to Dr. Ing. Enrico Brivio, general commissioner, Unione Contruttori Italiani Machine Utensili, Via Gaetano Giardino, 4, Milan, Italy.

Sept. 15-18. National Metal Trades Association. Plant management conferences, Sagamore Hotel, Bolton Landing, Lake George, N. Y. Association office, 122 S. Michigan Ave., Chicago 3, Ill., can supply more information.

Sept. 15-22. Society for Experimental Stress Analysis. Annual meeting, and joint session with first International Instrument Congress & Exposition, Bellevue Stratford Hotel, Philadelphia, Pa. Get complete information from society—P.O. Box 168, Cambridge 39, Mass.

Sept. 22. Cutting Tool Manufacturers Association. Fall meeting, Lochmoor Club, Detroit, Mich. Write association office, 416 Penobscot Bldg., Detroit 26, Mich., for more facts.

Sept. 23-26. Packaging Machinery Manufacturers Institute. Twenty-second annual meeting, Grove Park Inn, Asheville, N. C. Direct inquiries to Institute office, 342 Madison Ave., New York 17, N. Y.

Sept. 27-28. Steel Founders Society of America. Fall meeting, The Greenbrier, White Sulphur Springs, W. Va. Society office, 920 Midland Bldg., Cleveland 15, Ohio, can provide details.

Sept. 27-30. Society of Industrial Packaging & Materials Handling Engineers. Annual exposition, Coliseum, Chicago, Ill. Contact society office, 20 W. Jackson Blvd., Chicago 4, Ill., for more information.

Sept. 28-Oct. 1. Association of Iron and Steel Engineers. Annual meeting, Cleveland Public Auditorium, Cleveland, Ohio. Get more facts from association headquarters, 1010 Empire Bldg., Pittsburgh 22, Pa.

Sept. 30-Oct. 2. Porcelain Enamel Institute, Inc. Annual meeting, The Greenbrier, White Sulphur Springs, W. Va. Get details from Institute office, DuPont Circle Bldg., Washington, D. C.



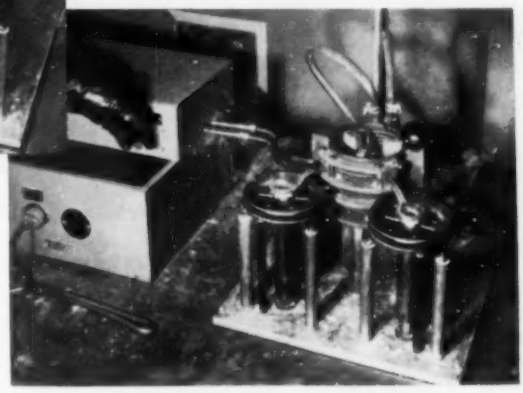


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Field Notes . . .

According to John J. O'Connell, president of The Society of the Plastics Industry, Inc., production of plastics is expected to double in the next four years. Should this production come about, this will mean 6-billion pounds by 1958. The current estimated production of 3-billion pounds of plastics materials represents a dollar volume of about $1.5 billion.

Mr. O'Connell's prediction is based on industrial interest in new plastic materials, fabrication techniques, machinery and applications. He compared the plastics industry to that of the steel industry at the turn of the century when alloys were first introduced, pointing out the many new techniques that were developed and new markets opened as a consequence of their advent. Copolymers, somewhat comparable to alloys, are now moving into the plastics picture. Styrene copolymers have stimulated a rapid rise in vacuum forming which is being utilized in many plastic applications formerly done by conventional molding techniques. Similar situations are being brought about in other plastics fields. Machinery developments indicate that automation in the plastics industry will come into its own during the next five years. In fact, automatic controls already make possible fast production of precision plastic moldings.

v v v

Tellurium alloy lead sheath cable is now being produced by John A. Roebling's Sons Corp. in full commercial quantity according to recent announcement. The company also revealed that several lengths of the tellurium alloy lead sheathed cable are now being tested by utility companies. Tests have confirmed the desirable qualities, showing that it possesses stabilized bending and creep-resistant properties of good quality. Extrusion in the Roebling factory has also shown that ease of control of the new alloy is one of its desirable characteristics. It can be extruded on a standard lead press, and allows a wide range of heat treatments.

v v v

Rensselaer Polytechnic Institute has been authorized by Frankford Arsenal, a U. S. Army Ordnance Corps installation, to extend its investigation into high-speed hydraulic components until the close of this year. Prof. Frederick J. Bordt of the mechanical engineering faculty at the Institute has been engaged in this research since July 1951 when the original contract between the Arsenal and the Institute went into effect.

expansions

Proposed expansion of The Bullard Co. will include a new and modern foundry scheduled for operation by the latter part of 1955. The new facility will be financed through sale of 121,440 shares of common stock covered in a Registration Statement filed recently by the company with the Securities and Exchange Commission.

v v v

Brown & Sharpe Mfg. Co. has announced its largest single development and reequipment appropriation in the company's history; The amount set aside is $2,000,000 which is to be used for modernization and retooling of the company's automatic screw machine facility located at the Providence plant.

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This appropriation is in addition to the firm's customary capital expenditure for routine replacement. It also is exclusive of an estimated $3,000,000 worth of other development costs incidental to implementing the program. According to Henry D. Sharpe, Jr., president of the company, this is the first installment on a long-range program, and he indicated that fruther long scale capital improvement projects were now under consideration for execution during the next few years. The current program to come under the present appropriation is expected to last 15 months.

V V V

Capacity at The Cooper Alloy Foundry Co., has been expanded by more than six tons of melted metal per day to meet demand for its ELC grade, an extra low carbon stainless steel which permits welding without subsequent heat treatment.

V V V

A 60-percent increase in its plant capacity is provided for the Schmieg Industries, Inc. with completion of its recent expansion program. The engineering department will now have an additional 1000 sq ft of space, permitting an increased efficiency in design and production facilities of the company.

V V V

Construction of a second continuous galvanizing line for production of galvanized sheets and strip is scheduled by Wheeling Steel Corp. The line, which will cost at estimated $4,000,000, will be located at the company's factory in Martins Ferry, Ohio, where the first such line was put into production. Plans place the beginning of operation of the new installation at May, 1955.

V V V

Completion of a new and larger plant for the Farmington Engineering Co. at 72 Granby St. in Bloomfield, Conn., near Hartford, has been announced. In addition to being designed for peak efficiency, the plant-expansion plans include production equipment and an augmented organization.

V V V

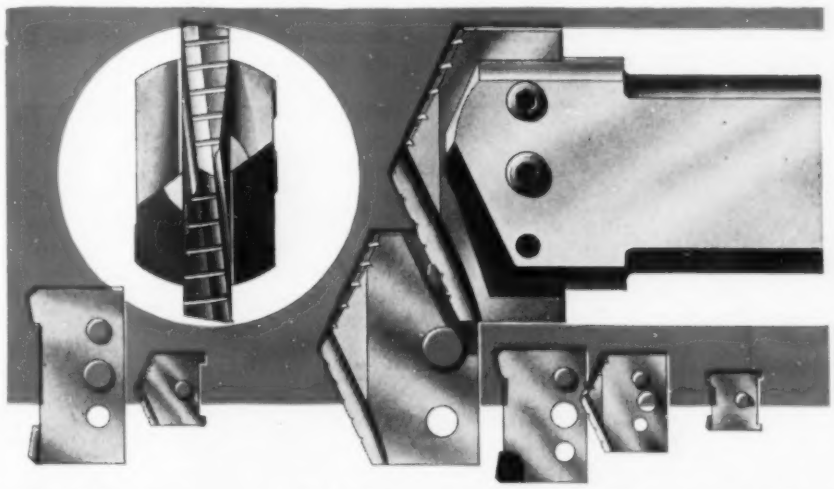
Formal opening of its new Lancaster, Pa. works was marked recently by Aluminum Co. of America. This is the company's first plant exclusively for the production of fasteners and screw machine products. The Lancaster works is almost solely devoted to production of aluminum parts on cold-heading and screw machines, although it also produces a small quantity of special machined magnesium parts. Its facilities will permit a wide range of secondary machining, finishing and heat-treating operations.

V V V

With the completion of the steel framework, construction is well under way on the Westinghouse Electric Corp.'s new air-conditioning plant at Staunton, Va. The finished facility will comprise almost 300,000 sq ft of manufacturing area, offering a five-fold increase in productivity of packaged air conditioners. In addition to the manufacturing structure the plant will also include a two-story office building. Completion of the new unit is expected by late summer of this year.

moves

Celebration of the completion of its Garden City plant was held coincidentally with the marking of its twenty-fifth anniversary for Allmetal Screw Products Co., Inc.



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Romulus Tool & Engineering Co. has announced its relocation at 13581 Huron River Dr., Romulus, Mich.

V V V

For faster handling of orders and to speed modernization of older machines, Samuel M. Langston Co., Camden, N. J., has moved its parts department into larger quarters. Increased efficiency is anticipated, both from making access easier and due to accommodation of larger inventory.

V V V

Larger accommodations, including a manufacturing plant and office area, have been acquired by Omer E. Robbins Co. at 24800 Plymouth Rd., Detroit, Mich. The new facility will permit considerable expansion in the activities of the company, which now will include in its manufacturing schedule special jigs, fixtures, build-up gages and special machinery.

new firms

Cosa Corp., importer of Swiss and German machine tools, has announced formation of an associated company, Cosa Corp. of Ohio. Sales and service throughout the Ohio area, which formerly was covered by Detroit Cosa Corp., another associated company, will be handled from the new office and showroom at 3315 Brookpark Rd., Parma, Ohio.

The Detroit firm now operates under a new name, Detroit Cosa Corp. and now will serve eastern Michigan from its office at 20118 James Couzens Hwy., Detroit 35, Mich.

V V V

Formation of the Design Development Laboratories in Peekskill, N. Y. has been announced by David F. Sklar, formerly of Kent Cliff Laboratories. The new organization will be concerned with design and development of scientific precision mechanical apparatus.

acquisitions

The research and development division and laboratories of the Merrill Co. a metallurgy and engineering firm in San Francisco, have been acquired by Arthur D. Little, Inc. ADL has recently established an office in San Francisco as a base for its West Coast technical-economic survey work. The newly acquired laboratories will be known as the Western Laboratories Div.

V V V

Pioneer Rubber Mills Inc., manufacturers of industrial rubber products, has been acquired by the H. K. Porter Co., Inc. The acquisition becomes part of the Quaker Rubber Corp., one of Porter's nine divisions. According to report of the transaction, this makes Quaker the only industrial rubber concern in the United States with factories on both the Atlantic and Pacific coasts. Sumner M. Suhr, sales manager who has been with Pioneer since 1917, was made manager of the new division.

V V V

The Meehanite Metal Corp. and the Blackmer Pump Co. have completed a contract giving Blackmer right to produce Meehanite castings in their foundry for use as component parts in their full line of industrial pumps.

organization changes

An application engineering division has been formed within its engineering department according to an announcement from Morse Chain Co. The division came about in order to meet application engineering requirements of the company's expanding lines of certain components. Ralph E. Cherry, former executive engineer of the Morse Detroit plant will head the division, while Earl E. Wesselhoff has been named assistant chief engineer.



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technical digests

Trends in Forging

By Robert G. Friedman
Vice President
The National Machinery Co.
Tiffin, O.

THE TERM FORGING has come to embrace many hot and cold forming operations in both ferrous and nonferrous materials. Today, the forging field is anything but static. Development of new methods and processes, tools and dies, is under way constantly.

Production speeds are increasing. Two or more forgings are being combined, adding to the size and complexity of shapes. Other forgings are being made smaller, stronger and to closer tolerances than ever before. This is the age of "gadgets"—a term which the trade has hung on the many odd-shaped components which can be more advantageously cold-forged instead of screw machined.

Industry has also learned how to precision-forge items such as jet blades and buckets to finish tolerances, in spite of difficult steels and shapes required.

Forging Blank Preparation

A steadily growing method of preparing forging blanks utilizes a rapid and unskilled rolling operation, *Fig.* 1. The rectangular blank is placed between two simple roll dies and against a stock gage, tripping the machine automatically. The blank is accurately reduced and elongated, ready for finish forging on the same heat in less than five seconds. This method replaces time consuming, fullering and edging in preparing blanks for odd shaped forgings. An entire heat is eliminated and production rates are considerably higher. The process also makes possible a savings in material.



Fig. 1. Reducing rolls provide accurate distribution of material for subsequent forging in minimum operations.

Precision Press Forging

The industry's quest for closer-tolerance forgings and lower machining costs has extended use of press forging as a production operation. Some installations are reporting four times greater output, unit for unit, over other forging methods. Further, the age-old requirement of artisanship in drop forging has been removed—replaced by know-how in modern die layout and press design. Most press forgings are made in only two or three blows. Mechanical ejection allows the designer of the forging to reduce draft, cutting material costs and machining time. Press dies, subject only to squeeze rather than impact, can be inserted with longer-lasting die steels. Die life is further increased by the shortness of contact time followed by immediate ejection of the forging. Forging presses run quietly and free of vibration. They require comparatively inexpensive foundations without the demand for periodic repair

Many military ordnance forgings are produced more economically by extrusion in a press. The 2.75-inch rocket head forging, *Fig.* 2, is hot-forged from round-cornered square stock. After centering and scale-breaking blow, the blank is hot extruded to produce the finished forging. The part is then drawn to a reduced diameter and wall thickness on the closed end. This forging can be produced at around 300 pieces per hour.

Hot extrusion of automotive wheel spindles, *Fig.* 3, permits a material saving of 30 percent over previous methods. This amounts to a saving of 10 tons of steel per day at a production rate of 400 spindles per hour. In addition, extrusion has brought about a saving of 20 machines, 4000 feet of floor space and 65 percent in labor costs.

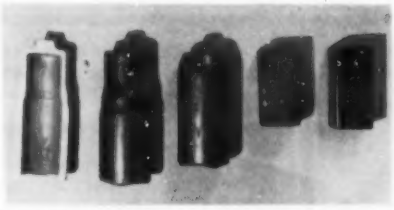


Fig. 2. Steps required in forging and hot extruding a rocket head.

A jet aircraft engine compressor blank is hot extruded from 403 stainless billet 1¼ inch round by 2 inches long. To save stock and reduce flash on the blade forging, the material is further formed in a third blow. These are examples of versatility in press forging operations.

Horizontal Deep Piercing

The horizontal forging machine continues to forge high explosive shells by deep piercing. All operations necessary

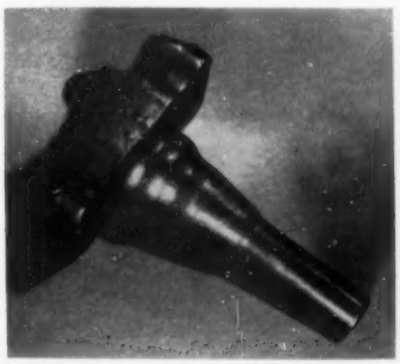


Fig. 3. Automotive wheel spindle produced by hot extrusion in a forge press.

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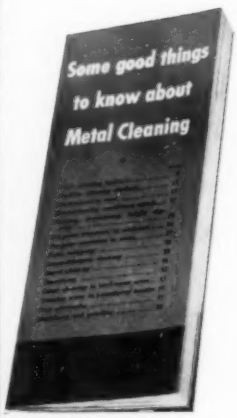
2 **PHOSPHATE COATINGS:** One material cleans steel while applying dense iron-phosphate coating. Another surpasses government specifications for heavy zinc-phosphate coatings. Lasting paint adhesion, protection against corrosion, ease of control.

3 **ETCH-CLEANING ALUMINUM:** Uniform etching in preparation for anodizing or painting. Scaling and sludging minimized or eliminated.

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to complete the shell case forgings are contained in one machine and are able to be accomplished in a single heat without intermediate annealing or coating. The secret lies in die engineering.

A number of highly successful automatic tong feed forging machine installations have been operating for several years on such high quantity items as push rods for valve-in-head engines, special long bolts for pole-line hardware and automobile rear axle housings. Another of the ultimates in hot precision forging is the automatic hot nut former. This new machine is capable of producing one-inch nuts at the rate of 85 per minute with 1½-inch nuts at 75 per minute.

Cold Forging

This process, applied to smaller parts and larger quantities, is leading the way to completely automatic forging at high speeds with substantial material savings. Cold nut formers, cold headers and progressive headers are already in production on thousands of different parts and gadgets which can be cold forged to advantage.

Another important trend in cold forging is the application of extrusion which simplifies accurate, high-speed production of tubular rivets. They formerly were cold headed and finished by costly drilling.

Odd-shaped parts shown in *Fig. 4* give an idea of unlimited possibilities in forging countless metal components.



Fig. 4. Cold-forged "gadgets" produced by combined heading and extrusion.

Multi-station progressive headers are producing close-tolerance parts seven to fifteen times faster than machining methods with material waste reduced up to 50 percent. Work involving double or triple extrusions or multiple heading operations where two or more different die impressions are necessary, is especially suited to the progressive header. A finished forging is produced on each stroke.

Conclusion

To continue progress in the field a number of factors require concerted attention for further improvement. They are: forgeability of raw materials, die materials, die lubricants, application of automatic forging methods and equipment to work now done by hand feeding.

From a paper presented at the SAE National Passenger Car Body and Materials Meeting, March 1954.

▼ ▼ ▼

Tool Problems in Automation

By A. O. Schmidt

Research Engineer
Kearney & Trecker Corp.
Milwaukee, Wis.

Even the most impressive array of machine tools, supplementary handling equipment and control instruments for automation depends upon the proper cutting action of the tool to deliver the expected performance.

The phenomenal cutting speeds often reported for a single test, and usually for comparatively light cuts of short duration, have limited use in automated machinery. It is much more important to keep the tool running as long as possible to eliminate time losses due to cutter changes, as shown in accompanying chart. With this in mind the range of cutting speeds for milling various materials with carbide cutters is between 250 and 350 fpm for cast iron and between 400 and 700 fpm for mild steel, but for aluminum and magnesium alloys speeds may go up to 10,000 fpm. These figures will be modified to suit various conditions of workpiece and type of operation.

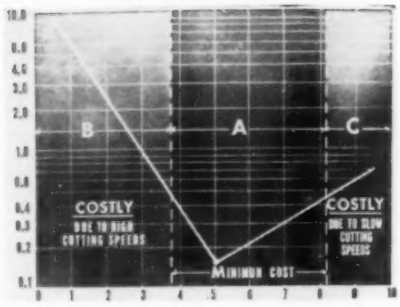
The number of workpieces made per tool grind may vary by as much as 100 percent from one lot to the next even with metallurgical control of microstructure, hardness and other factors. Dimensional variations in the workpiece will affect power requirements



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and greater depth of cut or higher feed rates will increase the power demand proportionately. Tool wear usually will increase the power requirement often by as much as 100 percent, and sometimes even more. Because of chip interference the majority of machining operations with automation are limited to cast iron. It is possible, however, to design the tool in such a way that it will produce short chips even when machining steel and other ductile materials. The successful solution of this problem either through metallurgy or tool design will open up an entire, new field for the application of automation.

Just as workpiece design has to be adapted to automation of the machining process, so too must tool design and along with it, tool wear, tool changing and regrinding be given primary consideration rather than be treated as an afterthought by automation engineers.



Relationship between machining time and cost in transfer type equipment. Area *A* is economical range. In *B* too high cutting speeds cause frequent cutter breakdown and changes.

Automation with the use of machine tools includes not only efficient materials handling, and short cutting times, but also special tool engineering to keep the tools working continuously to make this type of operation really economical.

Presented as part of the panel on automation at the 1954 Machine Tool Electrification Forum sponsored by the Westinghouse Electric Corp., Buffalo, N. Y.

▼ ▼ ▼

Preventive Maintenance–Pros and Cons

By O. W. Graveley
Works Engineer

Electro Metallurgical Co., Div.
Union Carbide & Carbon Co.
Niagara Falls, N. Y.

For some years many associated with plant upkeep have been following the path of prevention, while others have followed the older and less complex method of breakdown. Some reasons must exist for these divided ways. Thought association with the word "breakdown" can bring to mind unpleasant pictures of circumstances in connection with the factory, home or auto, while no such unpleasant thoughts are suggested by the word "preventive." What are the facts?

The Electro Metallurgical Company, a Division of Union Carbide and Carbon Corporation, instituted a program of preventive maintenance in its Niagara Falls plant in 1947. It manufactures ferro alloys, metal chemicals, calcium carbide and acetylene gas. There are some 3,000 people engaged in this manufacture at its Niagara plant, 400 of whom are in maintenance.

Preventive maintenance is a completely planned procedure. It requires the cooperation of operating departments. Equipment must be made available for inspection or repair on schedule, if operations permit. Operators must be notified in advance if the maintenance department cannot keep its schedule. The operating department foreman takes part in all planning and scheduling in his department.

These are the two methods of caring for equipment and buildings. Both types of approach may be logically applied to different phases of the same piece of equipment.

Where experience shows that certain emergency repairs do not reduce production or increase over-all costs of maintaining equipment, it may be that such repairs can be best handled as the actual need demands. However, this can only be done economically if a substantial part of the total repair labor

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requirements is planned. Otherwise, since it is obvious that actual breakdowns cannot be predicted, to meet extreme conditions a higher than needed labor force must be maintained or excessive overtime premiums and lower efficiencies of labor will inevitably result to meet the peaks in demand.

There can be no denying that a plant which operates on breakdown repairs has a greater incidence of deferred maintenance than one operating on a preventive maintenance plan.

Preventive maintenance requires trained personnel, constant attention, established routines and records. These have a way of increasing beyond need unless checked occasionally and should be kept to a minimum.

Here is one actual experience of breakdown repairs and preventive maintenance. A coke drying system, repaired on a breakdown basis for a period of years, had an annual output of 65,000 tons and a repair cost of approximately $2,000.00 per month, and when placed on a preventive basis, had an annual output of approximately 100,000 tons and a maintenance cost of approximately $1,600.00 per month.

The example stated is exceptional, but indicative of the results that can be obtained by careful planning. This is especially true where multiple units form a manufacturing system, and down time to a single unit interrupts production. With preventive maintenance the repairs to all units requiring attention are made during a single production shutdown, while with breakdown repairs an interruption is required for each job on a unit.

From an address given at the 1954 Plant Maintenance and Engineering Conference, Chicago, Ill.

▼ ▼

Impact Extrusion

By Louis Schuler, Goeppingen

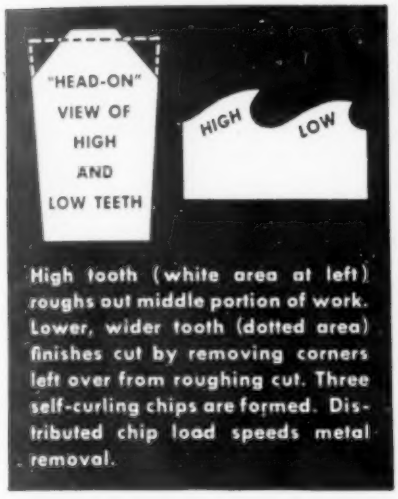
Wüerttemberg, Germany

In addition to methods of manufacturing hollow bodies by means of seaming and soldering, the cold extrusion process is finding a constantly increasing field of application. It is employed for both nonferrous and ferrous metals, being first introduced some seventy years ago for the manufacture of tin and lead tubes. Since 1934 it has been successfully applied to aluminum and zinc. More recently, attempts were made to cold form ferrous metals such as carbon steel, alloy steel and stainless steel. The great advantage of the

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process lies in the fact that cylindrical shells with lengths greater than 1 ½ to 2 times diameter which would require several draws normally, may be produced with one stroke of the press. A

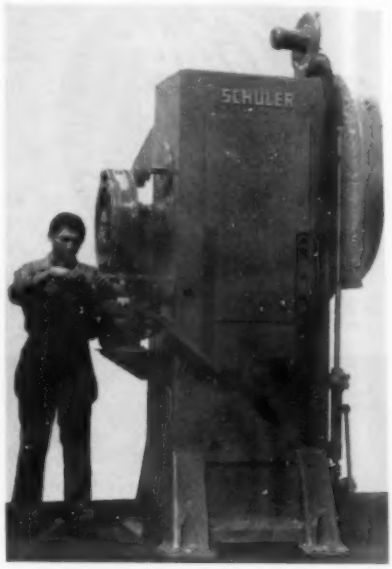


Fig. 1. Vertical crank press with automatic drum feed for cold extrusion of tubes and shells.

good surface finish is secured with greater strength. For aluminum the increase can be up to 80 percent. Aluminum and lead can be deformed up to 95 percent. Possible length of a cylindrical shell is up to 10 times slug diameter for a wall thickness between 0.08 and 0.1 mm. Zinc, however, shows no appreciable increase in strength and the possible length is up to six times the slug diameter for a wall thickness between 0.3 and 0.6 mm.

Production of steel components by the process is more difficult than light alloy. Increase in strength reaches 30 to 40 percent with deformation of 70 percent. Carbon steels of 0.2 percent with 30 to 40 kg/mm^2 tensile and 35-percent elongation are suitable.

By the extrusion process the material is caused to flow by pressure as opposed to deep drawing where it is stretched. A distinction should be made between two basic types. The first is where the metal flows in the same direction as the punch and the second is where it flows in the opposite direction. A combination of the two types is also possible. Power required for this method of cold forming is approximately twice that for deep drawing. Presses designed for extrusion are therefore particularly strong and rigid with a considerably greater reserve pressure.

Machines employed are horizontal

and vertical crank and knuckle joint presses such as shown in *Figs.* 1 and 2. Working speed is surprisingly high. Presses of 100 to 160 tons can be run up to 90 strokes per minute. Because of this high output the presses shown are fitted with an automatic slug feed. The automatic drum feed fitted to the vertical crank press, *Fig.* 1, permits use of optimum working speed with either round or hexagonal slugs.

Often, a belt conveyor is used to transport extruded parts from the press

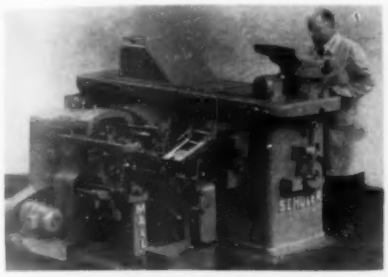


Fig. 2. Horizontal knuckle-joint press with six spindle tube finishing machine.

to an automatic machine which carries out further operations. For instance, collapsible tubes are fed into a multi-spindle automatic for trimming to length, deburring and threading, *Fig.* 2. Cylindrical shells are trimmed to length and provided with thread necessary to receive the screw cap on a high-speed thread rolling, trimming and beading automatic.

From a German technical paper "Machines for the Pressworking of Metals."

▼ ▼ ▼

Competitive Use of Engineering Talent

by Joseph H. Gepfert

Reeves Pulley Co.

Cleveland, O.

The present business trend toward greater competitive pressure on all organizations makes it imperative for them to review the effectiveness of internal operating groups. When the profit and volume spread of a product narrows, overhead burden must also be reduced in proportion, in order to stay in the field or in business. Internal cost can be reduced by effective coordination of engineering, sales and production.

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tween the three groups in any business, is essential. The direction and control of the team is the function of management. Decisions of management, however, are usually based upon the information and conclusions submitted by each of the three groups.

Although most decisions that affect all three are a compromise, the trend is in favor of the group that presents the most convincing story. In some businesses the trend becomes an overemphasis in favor of one group which leads to resentment by the others to the point of completely breaking down the team operation.

Management has a difficult job in developing a coordinated team because it is not only dealing with individual personalities, but also with three general types of individuals. In spite of generalization of characteristics the groups do work together in every successful business. The groups each have a specific function that must be part of the organization.

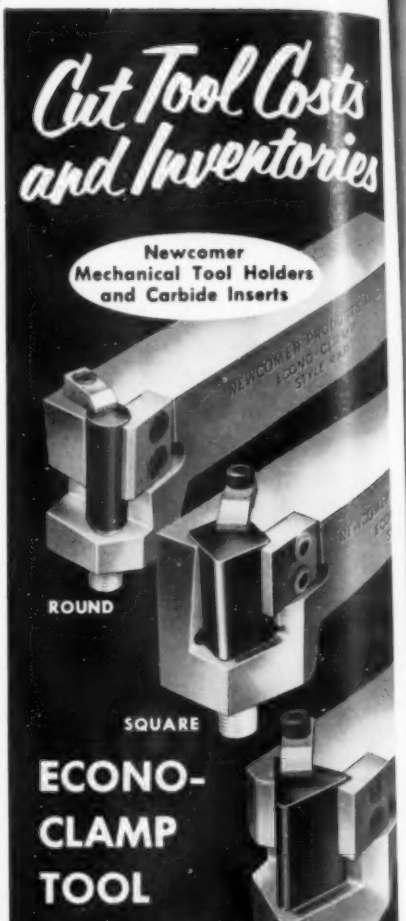
Division of Responsibilities

The sales group has the responsibility of selling the company product, usually in direct competition both of price and quality. They naturally want every advantage they can get in price, in quality or of special features that can be developed. Not only do they want to lead with their product, but they also demand equal and necessary changes to keep up with the competitive products. Since there usually is a continuous change in products and fields of activity, sales departments continually bombard management for corrections, additions and redesign of their product.

The production department must produce the product at a cost that will allow for profit at the field price and do it for any quantity sold. They want the product engineered to fit their production tools and methods so the cost line can be held. When the basic cost and method has been established they do not want it changed, hence they will try to hold product design changes to a minimum in order to hold down production costs.

The engineering department must try to satisfy both groups, which is usually out of the question. At the same time, engineering has the basic job of designing, altering and improving the product. This means that when they come up with an answer, it must satisfy sales and not alienate production.

Management must make a decision in each case and the engineering group is in the unhappy position of either



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having work wasted if they lose the discussion or of having an overload of work thrown at them with a deadline, to take care of the compromise solution.

The natural step in most businesses has been to take the engineers out of their cloistered cells and get them into the field to develop a better perspective of product requirements. This calls for a new kind of engineer whose attitudes break across characteristic lines. It makes no difference what members of this new group are called: sales engineers, application engineers or staff engineers; management must develop and recognize this engineering field group to complete the operating team.

The personnel for the new group usually exists or can be developed from existing engineering group. Naturally the men need some special training, but as long as the man is technically competent and congenial, he can by field experience and sales aid be taught enough to get a good perspective.

Management has the prime responsibility to clear the decks now for action in reorganizing its team on a new basis. Engineering method must be applied to product problems and engineers must be brought into management planning.

The first step is to educate the engineering group in the basic concepts of business economics and sales by field experience. Management cannot afford three separate groups in a competitive business and certainly the engineer-designer group is the one that can do the most for the team.

The building process will take time. For the fellow with logic and statistic it will be hard to fit into a business-sales operation. But results will be well worth the effort. In fact, it is almost imperative to develop a staff group with engineering thinking to compete for place in the field.

From a paper given at the 1954 Machine Design Conference of the Cleveland Engineering Society.

▼ ▼ ▼

Fusion Brazing of Titanium and Its Alloys

By Roger A. Long and Robert R. Ruppender

Aircraft Components Div. Ferrotherm Co.

The furnace brazing of titanium requires basically a time cycle longer than that of torch or induction brazing. The use, therefore, of a fusion brazing alloy instead of a diffusion filler alloy would tend to eliminate the formation of intermetallic layers of brittle compounds which form as a time function. A development of suitable alloy with this approach in mind would be commercially practical.

Development was based on the above as well as on flow temperature of the filler metal, time at temperature and the necessary ability of the brazing alloy to dissolve thin oxide films if present.

The nickel-titanium combination seemed to offer the least resistance to development. The system contained two eutectic compositions of somewhat low melting points. Utilizing these eutectics as a base alloy, elements were added to lower the flow temperature, increase wettability, and maintain an even hardness gradient across the brazed joint area from parent metal to parent metal.

Ultimate shear strengths varied from 40,000 to 70,000 psi, depending on the alloy utilized. Failures occurred outside the joint area and in the parent metal. Brittleness in the joint area was not determined in these preliminary tests.

From a paper presented at the 2nd annual welding show and 1954 spring meeting of the American Welding Society.

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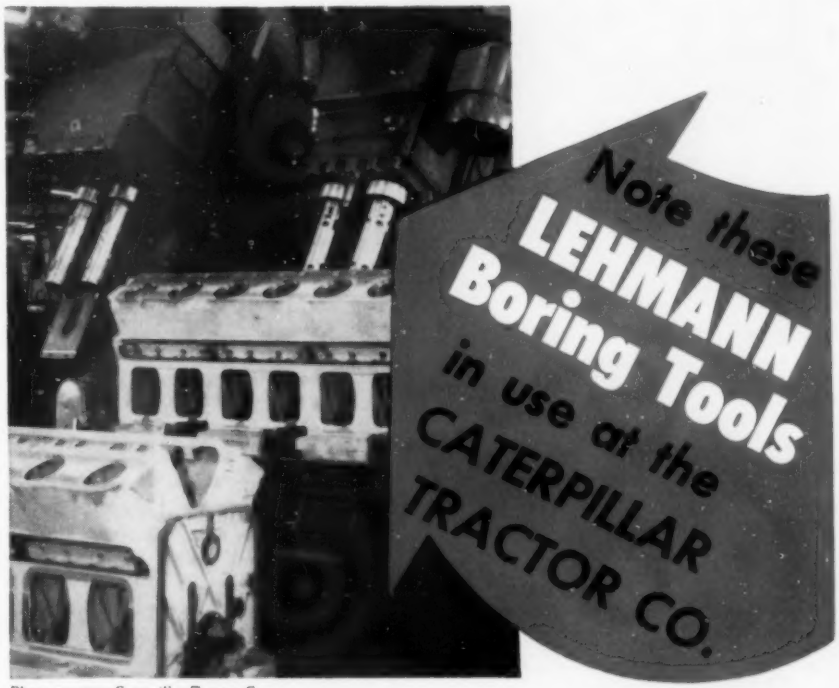


Photo courtesy Caterpillar Tractor Co.

LEHMANN Boring Bars used for rough and finish boring in these blocks for cylinder liners

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Tooling and Planning Transport Aircraft Production

by J. R. Franks
General Supervisor, Planning
and
C. S. Glasgow
Chief Tool Engineer
Douglas Aircraft Co.
Santa Monica, Calif.

In addition to configuration headaches, because of customers' needs, the commercial aircraft business also introduces a problem of tool selection. Tooling policy has to be flexible and vary according to actual detail part requirements. Customers' purchases vary in amount from one airplane to seventy-five. Consequently it is necessary when tooling for parts that are peculiar to a single customer to consider the total amount and the sequence of use of the individual part.

By estimate a single DC-6 type airplane contains 45,000 individual parts that must be planned and controlled. Less than 30 percent of these parts are basic parts used on all airplanes. The amount of basic parts diminishes slightly with each new customer configuration and greatly with each basic model change, *Fig.* 1.

Typical of problems, 152 different parts are involved in a new titanium nacelle. Use of titanium resolved itself into an almost normal problem. Engineering restricted the use to pure titanium and to the type of parts of a more or less primary forming category, that is, parts that could be made by power brake and stretch press forming.

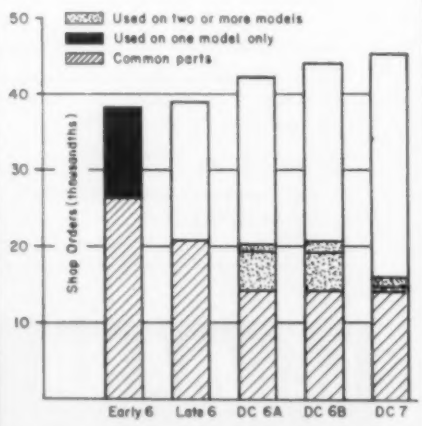


Fig. 1. Common parts used on current production models compared to individual or limited use parts.

It was apparent, because of cross-section inconsistency, that hot brake forming was not going to produce acceptable parts where subsequent stretching and joggling operations were required.

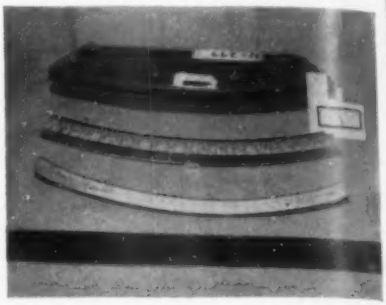


Fig. 2. Standard stretch blocks used to form Zee sections of titanium.

A successful attempt was made to size a power broken titanium Zee by running it through the last pass of the roll machine which was available for the DC-6 part. The heel line of the titanium part was moved as much as ¼ inch without cracking when sized.

Stretch forming of titanium skins proved extremely successful with both normal and parabolic dies. The parts were stretched over standard blocks with no springback allowance. Most all of the Zee's had varying bevel flanges ranging from 2 degrees closed to 40 degrees open and the parts formed in well on the stretch operation with a small amount of handwork required. It was found that handwork was reduced if the flanges were formed 2 degrees closed before stretching, *Fig.* 2. All joggling and dimpling operations were performed with the material heated to a temperature of above 600 degrees, *Fig.* 3.

The same equipment, similar tools, the same personnel were used to stretch form titanium as is used for stainless sheet steel fabrication. Damaged, broken and unacceptable parts were actually lower. The quality of the part was above average.

Blanking and shearing operations were done under conventional procedure for stainless sheet. The pierce blank template operated equally well on titanium. Hot brake forming, dimpling and joggling were done under accepted procedures without any difficulties which might be peculiar to titanium.

Another item of current interest in the aircraft industry is the use of optics for the construction and tolerance control of tooling.

In certain applications optical methods of tool construction and subsequent recheck inspections have high merit. DC-7 upper and lower half fuselage

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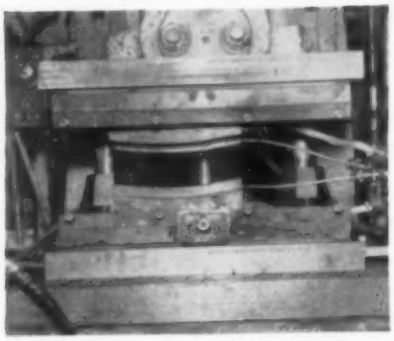


Fig. 3. Forming titanium joggles and dimples with parts heated to 600 F.

jigs, for example, are constructed using optical methods. Check points are being added to some existing jigs to provide for optical tooling level checks.

The following advantages result from this system:

1. Reduced tool fabrication time.
2. Rework may be accomplished without removing the tool from the area.
3. The area around the jig need not be clear and accessible as with the level and transit method of rigging.
4. Greater accuracy because of reduced errors of observation.
5. Rework may be accomplished without removing work stands.

This is an over-all picture of some of the more important items in tooling and planning commercial transport manufacture.

From a paper presented at the 1954 SAE Annual Meeting.

▼ ▼ ▼

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Waste Treatment for the Metal-Finishing Industry

by L. E. Laney, Ph. D.
Consulting Engineer
Elwood City, Pa.

The metal-finishing industry is one of the most important groups among industrial polluters of water resources. The main reason for this is that a large number of relatively small concerns, widely dispersed over the country, constitute a large percentage of the industrial capacity. Another contributing factor is the highly toxic nature of chemicals employed. Even trace quantities of these materials are lethal to aquatic life, thus dilution is not too effective as a natural remedial action.

Elimination of metal-finishing waste is possible for even the smallest plant without a great expense. Neither the physical plant, nor the operating expenses are of sufficient magnitude to affect economy of operations. Future electroplating plants can be designed to completely eliminate all toxic waste regardless of lower standards allowed by local conditions. The cost of waste treatment is small and well worth benefits derived.

Polluting waters discharged by metal-finishing industry may be divided in two categories; the first consists of concentrated waste such as spent acid-pickling solutions, alkali cleaners, highly acidic bright-dipping and passivating solutions and the like. Some of these processing solutions may be regenerated or otherwise extended in their usefulness, but the greatest percentage have to be disposed of as waste due to economic necessity. Though high in dissolved salt or organic load content, these wastes are a minor problem. The volume to be handled is relatively small except in very large plants. The waste treatment process is simple and the bulk of sludges is inconsequential. The second type of waste consists of dilute solutions resulting from washing parts in process free of chemical compounds. Due to relatively high concentration of chemical compounds in various process solutions, large quantities of wash waters are required to maintain a dilution factor high enough to avoid a film of dissolved chemicals on the work in process. These, when reacting with chemicals contained in the mixed process solution, might lead to a precipitate on the surface to be finished. Another danger is continuous drag-in of foreign chemical compounds that would soon pollute the processing solution next in the line.

Some reduction in quantity of wash waters required may be accomplished by reducing the drag-out to an economical minimum. Generally it is un-

economical, however, to attempt restricting the rate of water consumption in a metal-finishing process.

The treatment of these dilute wastes is actually the problem facing the metal-finishing industry in waste treatment. Since a finishing plant usually employs a number of different process solutions, rinse waters are contaminated by different chemical compounds which require different but specific chemical treatments; it is necessary then to segregate waste waters according to subsequent chemical treatment cycle.

From these considerations it follows that to eliminate toxic compounds before they are washed off would meet the requirements for profuse rinsing without causing pollution. Therefore, it is necessary to integrate waste elimination steps into processing sequence and establish treatment as an organic part of the whole process. Objectionable chemical compounds may be removed from working process before they reach the sewer by either recirculating rinse waters through ion-exchangers or by chemical treatment preceding the rinsing steps. This particular discussion is restricted to integrated waste treatment system based on chemical methods. The chemical treatment solution is kept in a closed system and not wasted as a rule, but may be discharged after prolonged use. The requirements for a satisfactory treatment solution may be enumerated as follows: (1) it should not tarnish, discolor or stain the work; (2) it should not harm functional qualities of finish, such as corrosion resistance, activity for receiving subsequent electro-deposits, paintability, paint-adhesion, etc.; (3) it should give instantaneous reaction with toxic compounds; (4) it should lead to a precipitate or gaseous break-down product to eliminate undue chemical build-up and need for frequent dumping. An example of such a system is shown in *Fig.* 1. This provides for treatment after copper plating from a

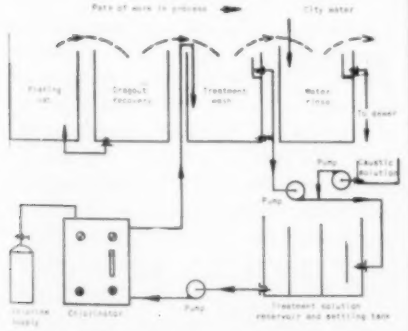


Fig. 1. Sketch of wash station for treatment of copper plating waste, cyanide electrolyte.



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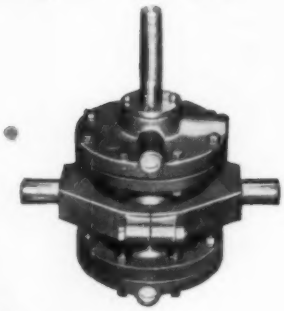


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cyanide-type electrolyte. A physical plant consists of a treatment wash station in the copper-plating line, usually following a save-rinse step immediately following the plating tank itself. The treatment wash solution is constantly recirculated from the treatment solution reservoir. Chlorine gas and caustic soda or a hypochloride solution is constantly added to the reservoir to replenish chemicals consumed. The reservoir, besides fulfilling usual function of maintaining a more even chemical concentration level and acting as a settling tank, should also be of sufficient size to reduce possible cyanide drag-out.

Nontoxic salts such as sodium-chloride, sodium-carbonate, etc. slowly accumulate and should be discarded periodically. Another example is the treatment after chromium-plating. *Fig.* 2.

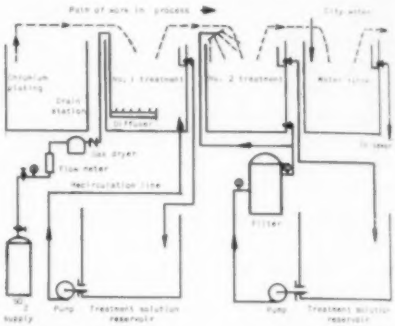


Fig. 2. Sketch of a wash station for treatment of chromium plating waste.

In this a two-step process is usually employed. The first treatment insures reduction of the hexavalent chromium to the trivalent state while the second treatment serves for the precipitation of the chromic salts. Advantages of this type of system are the small capital outlay for treatment equipment. The waste treatment is integrated into the finish line, eliminating the need for a separate plant.

Need for close chemical control is eliminated and no separate personnel is required for operation of the system The integrated waste treament also has beneficial effect on primary finishing process. Cleaner, stain-free finishes are achieved. Chances for contamination of the process solutions are eliminated. Need for better housekeeping teaches better working habits, improves efficiency and reduces chemical waste. It is hoped with further experience that the process will prove to be a simple engineering solution for a complex and annoying problem.

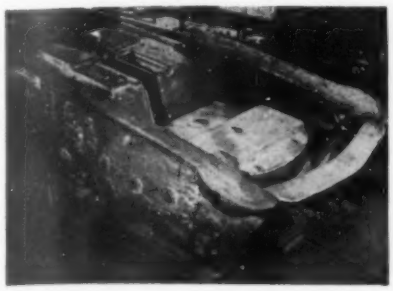
From a paper presented at the December 1953 meeting of the American Institute of Chemical Engineers.

Cast Aluminum Tooling for Plastics Production

by Jack Cuming

Vice President and General Manager
M. A. Cuming & Co., Inc.
New York, N. Y.

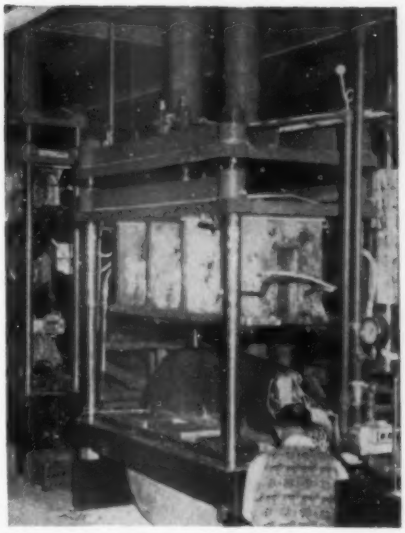
Cast aluminum molds have been widely used for successful tooling in the reinforced plastics industry since its beginning. In recent years, cast aluminum molds have been found particularly suitable for large reinforced parts such as automobile bodies, aircraft wing sections, radomes, large tanks, etc. The properties of cast aluminum molds which make them ideal for these large parts include:



Rear body mold of Willys-Kaizer automobile. Thickness is two inches with cast-in steel heating coils spaced at regular intervals. Molds were made in large sections bolted together and are used for bag molding.

1. Low cost—approximately 25 percent of the price of machine steel molds on compound shapes.
2. Fast machining—aluminum may be readily shaped and fitted by grinding and hand scraping.
3. Good corrosion resistance—not necessary to chrome plate.
4. Uniform heat—due to high conductivity hot spots are practically eliminated especially if a thick-walled casting (2 inches) is used.
5. Light weight—easier to handle and press mount.
6. Readily welded.
7. Aluminum shrinkage—approaches the shrinkage of glass mat laminate closer than steel.

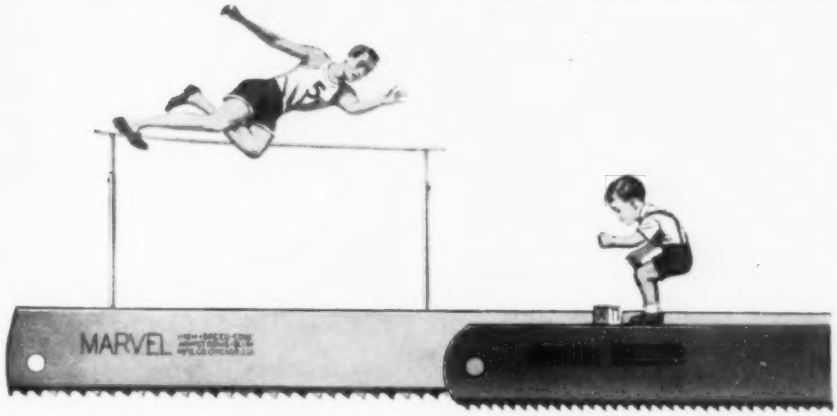
Large cast aluminum molds are made in four steps. The pattern is made in plaster or wood with shrinkage allowance of approximately $\frac{1}{8}$ inch per foot, with a 2-inch wall thickness to allow for casting in a steel tube heating and cooling grid. For the casting, usually 4-percent copper silicon alloy is used to give a relatively hard surface, good strength characteristics and easy machinability without galling.



Large aircraft parts being molded on matched cast aluminum dies.

In fitting, an accurate plaster master block is fitted to mold by blue blocking heavy flexible safety grinders and hand scraping. Approximately $\frac{1}{8}$-inch material is removed in this operation. In matched molds, the female is finished first and the male spaced with clay or wax to give proper thickness. The final step is polishing for the removal of all surface marks by buffing and fine grit grinding. Life of large aluminum molds is limited only by the care given in protection is storage since wear from laminates in most shapes is negligible.

From a paper presented at the 1954 technical and management conference, Society of Plastics Industry, Inc.



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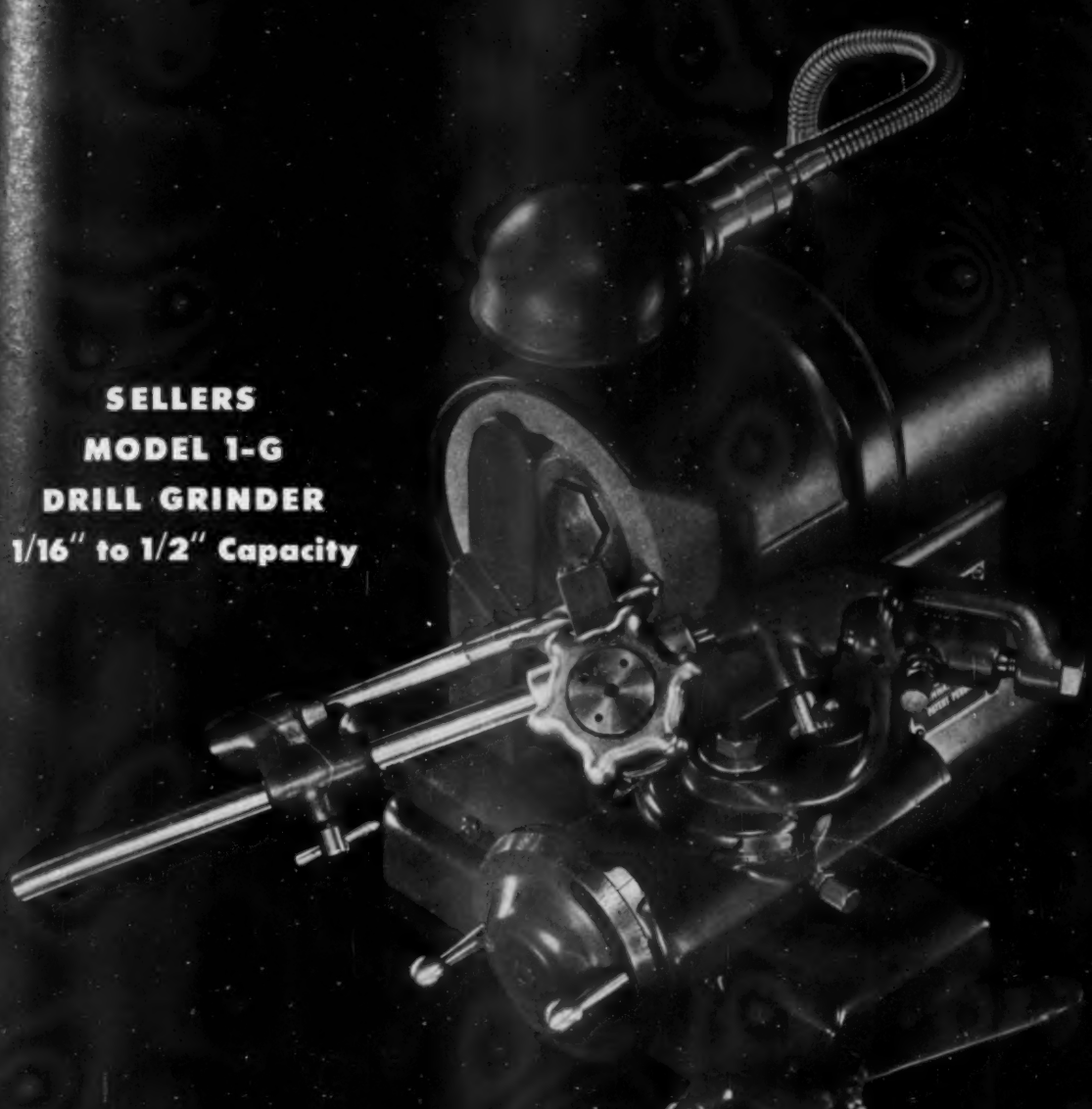
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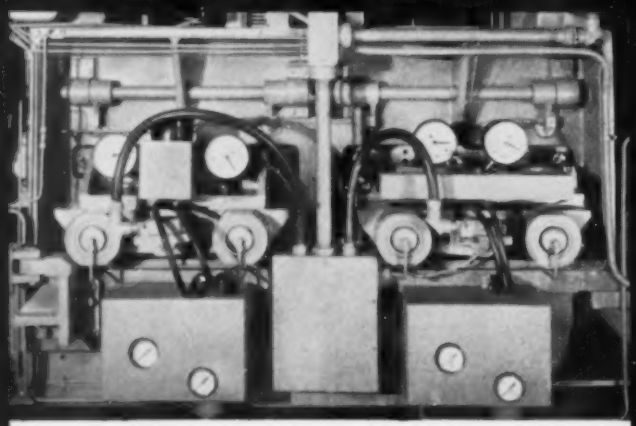
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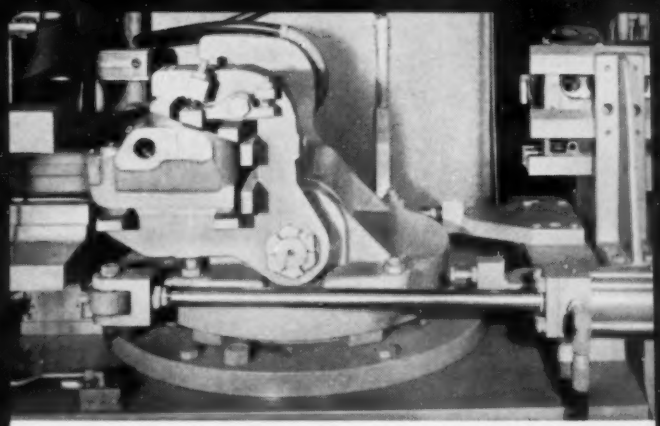
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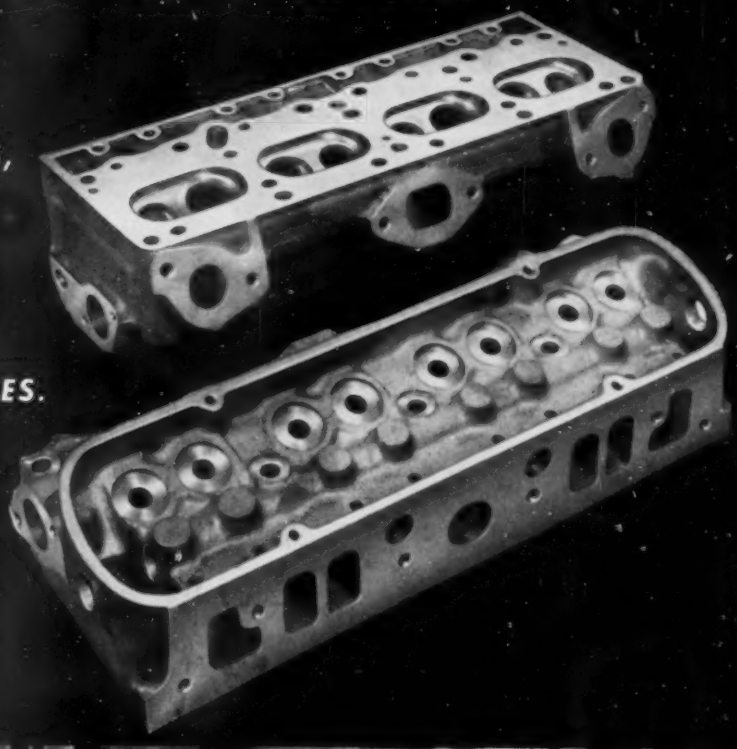
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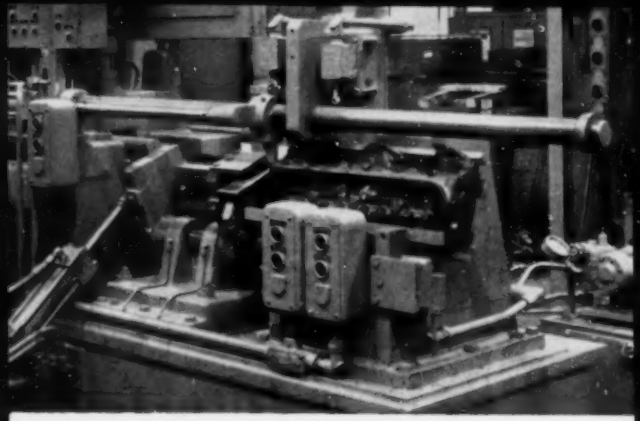
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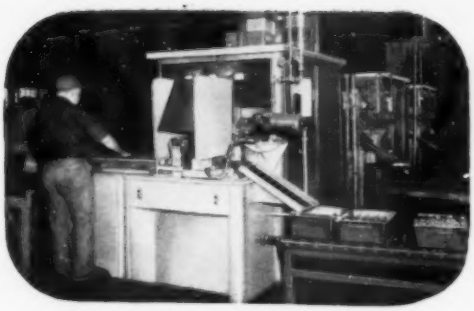
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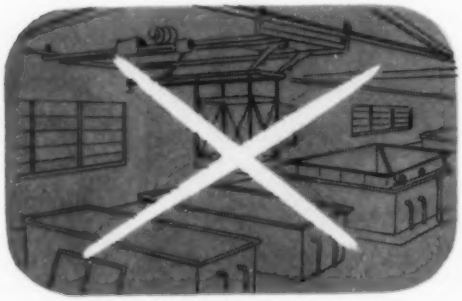
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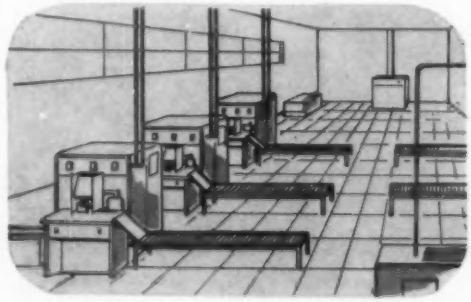
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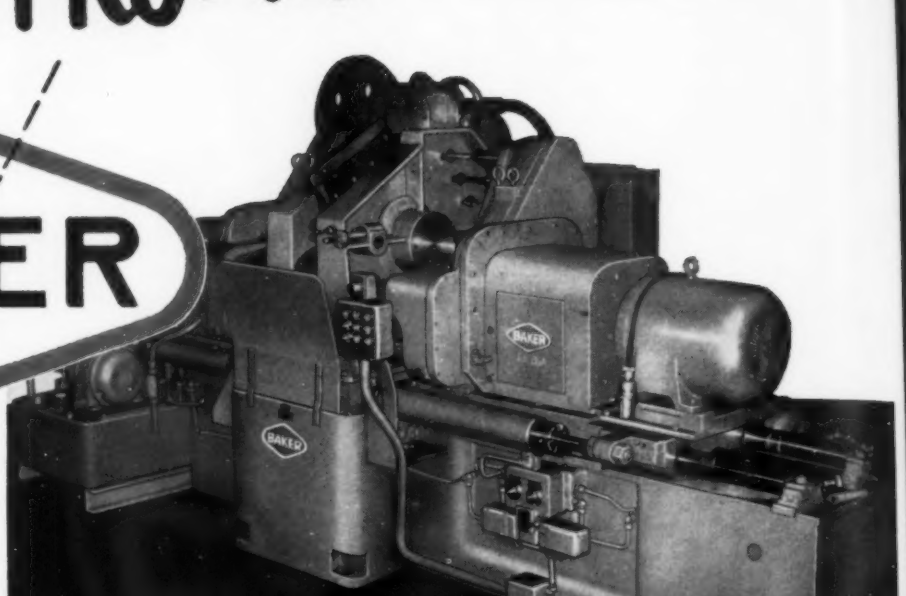
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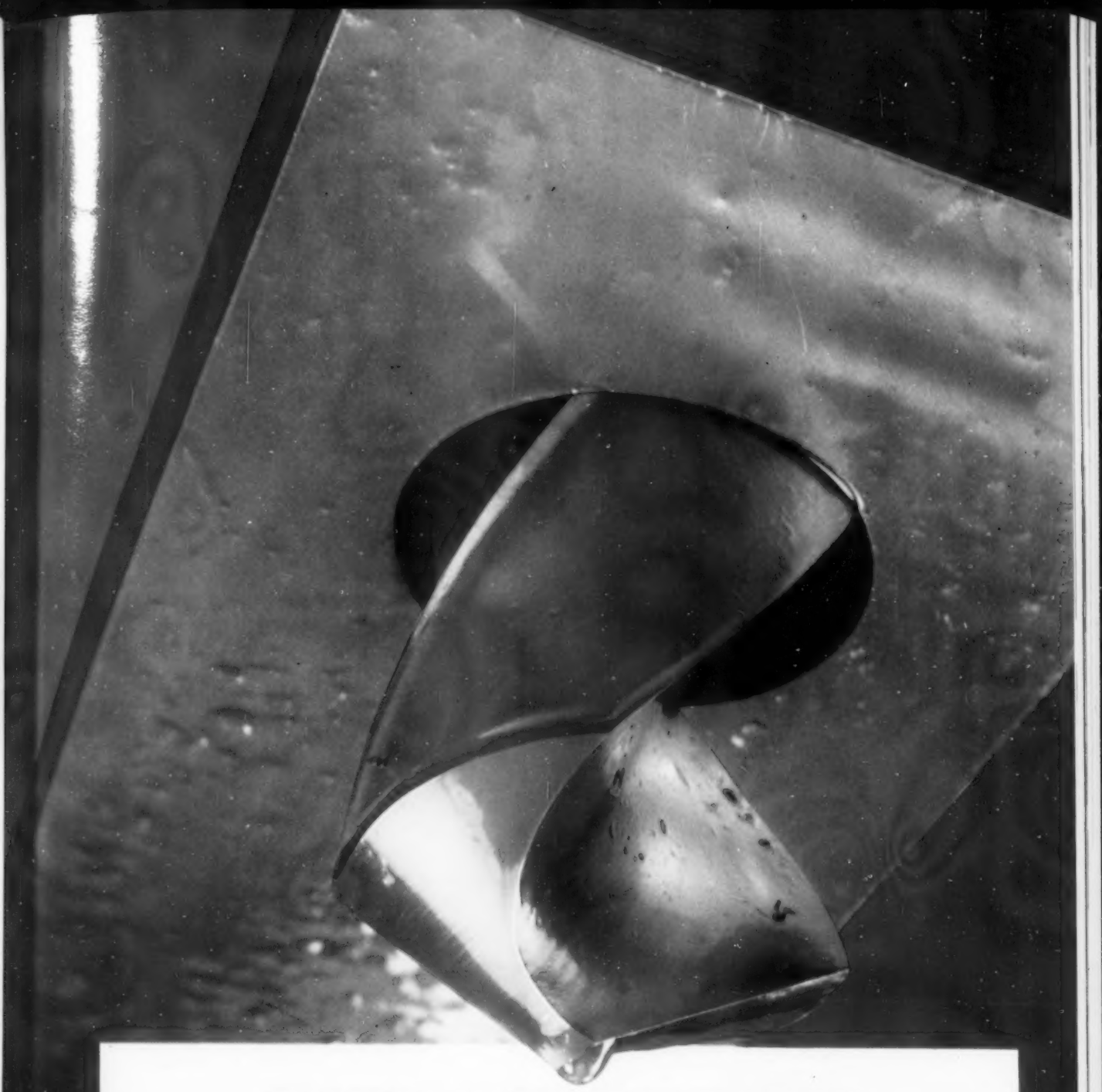
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Second sheets, plain, white or yellow	per 1000	2.50
Copy sheets, white with AMERICAN SOCIETY OF TOOL ENGINEERS and COPY printed in black	per 1000	4.50
ASTE Banner, blue satin with gold lettering reading AMERICAN SOCIETY OF TOOL ENGINEERS and bearing ASTE emblem. Banner is complete with a rod inserted at the top and a gold colored cord for hanging.		15.00

(Imprinting of Chapter name and number can be done but at extra cost)

Orders for any of the above items must be accompanied by remittance. (ASTE Chapters may, upon request, have the purchase price deducted from their next allocation check) Please direct all orders to:

AMERICAN SOCIETY OF TOOL ENGINEERS

10700 Puritan Avenue **Detroit 38, Michigan**

PARKER • MAJESTIC PM PRECISION MACHINES

25 Years of Progress



Pictured here is the home and products of

PARKER-MAJESTIC, INC.

Established in 1929, this company has for 25 years manufactured the **Parker** Spindles used in Precision Grinding, Boring and Milling applications. Additional products include the well known line of **Parker-Majestic** Internal, External, No. 2 Surface and Rotary Surface Grinders.

Descriptive literature upon request.

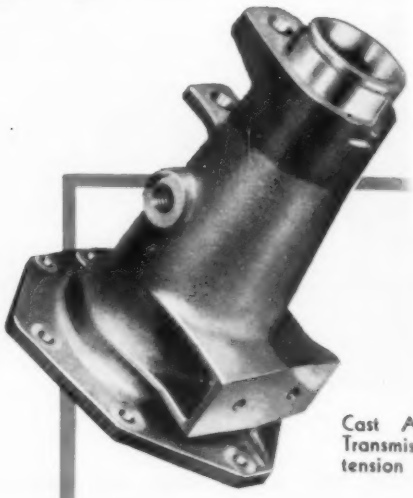
PARKER-MAJESTIC, INC.

147 JOS. CAMPAU • DETROIT 7, MICHIGAN

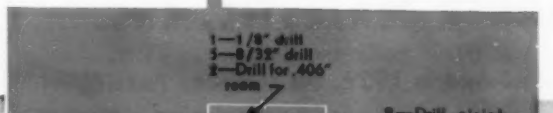
118 *Pieces per hour* 35 *Operations*

TRANSMISSION EXTENSIONS MACHINED TO CLOSE TOLERANCES ON COMPANION UNITS

Here is another typical example of how W. F. & John Barnes coordinated special machine engineering and building service helps solve complex machining problems. These two companion units, designed to machine cast aluminum automobile transmission extension housings, reduce production costs by combining operations. Note how the parts are positioned and the tooling arranged for efficient machining, and how the over-all design conserves floor space. The two machines perform 35 operations at the required gross production rate of 118 pieces per hour. Whether your production requires large or small machines, you'll find the coordinated services at Barnes can help you solve problems quickly and efficiently.



Cast Aluminum Transmission Extension Housing

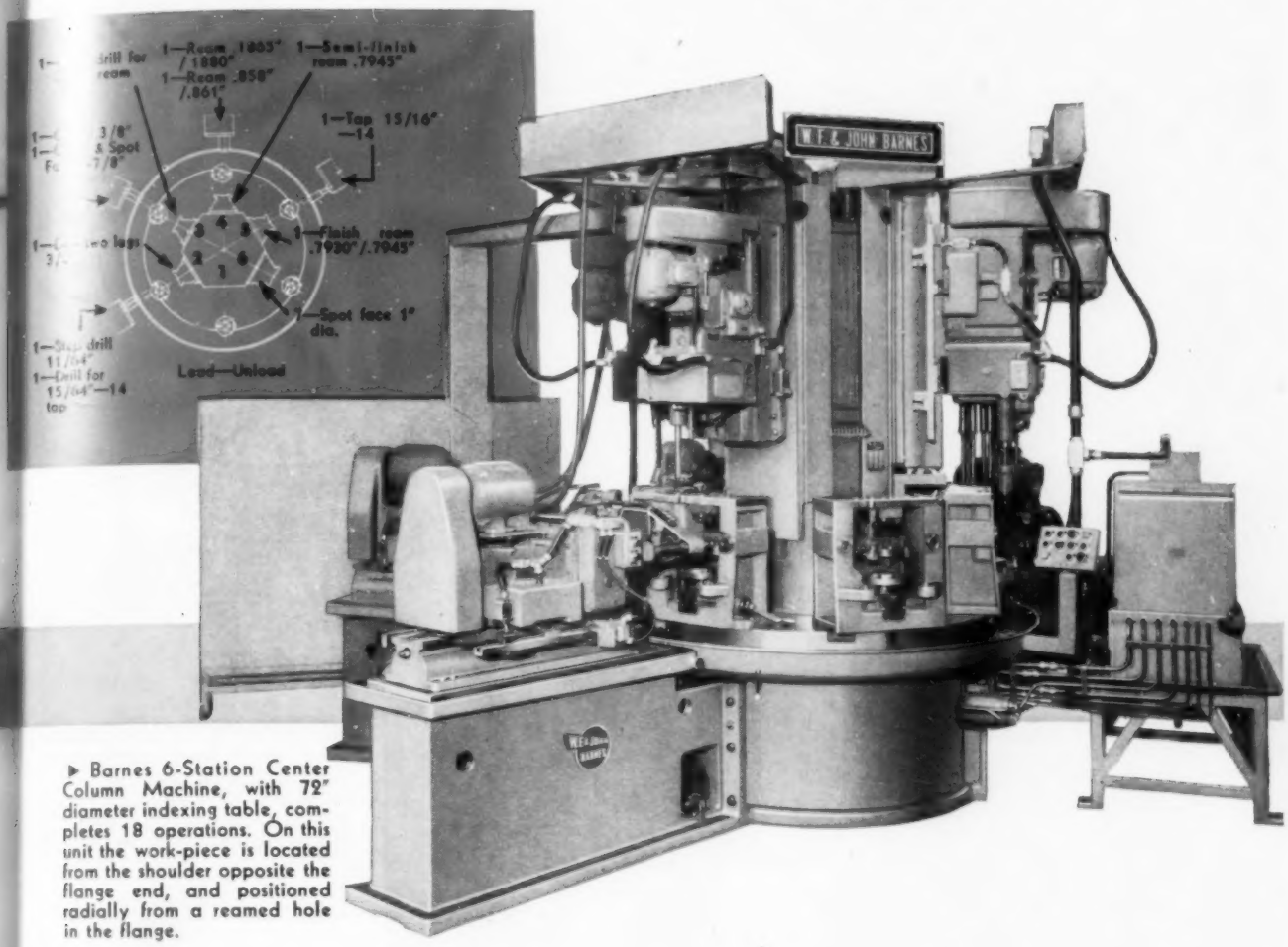


Barnes 4-Station Special Machine with 48" diameter hydraulically operated rotating table. This unit performs 17 operations. Vertical milling of bottom pad in Station No. 2 is completed with a retracting spindle. Fixtures locate part on end bores.

W. F. & JOHN BARNES COMPANY

MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINES

...ON W. F. & JOHN BARNES SPECIAL MACHINES



▶ Barnes 6-Station Center Column Machine, with 72" diameter indexing table, completes 18 operations. On this unit the work-piece is located from the shoulder opposite the flange end, and positioned radially from a reamed hole in the flange.

BARNES SPECIAL MACHINE TOOL BUILDING SERVICE INCLUDES

1 **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to produce high production machines.

2 **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.

3 **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control with circuits that assure the most dependable coordination of all machine functions.

4 **SPECIAL GAUGES, FIXTURES, TOOLS** — designed for each individual machining problem, assure accuracy of operations at high production speeds.

5 **SPECIAL HANDLING AND CONVEYOR EQUIPMENT** — designed and built to reduce work handling, effect maximum safety and efficiency.

6 **COORDINATED DESIGN AND ENGINEERING** Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.



Write **FOR FREE DATA**

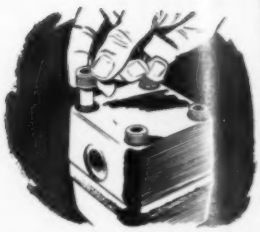
"Coordinated Machine Engineering" — a free booklet describing modern machines and mass production techniques. Write for your copy today.

313 S. WATER ST., ROCKFORD, ILLINOIS

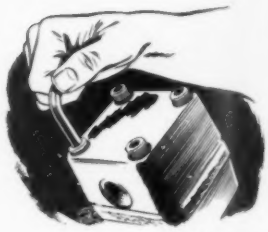
AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES



Four UNBRAKO Socket Head Cap Screws speed assembly in the plant, and reassembly in the field, of these flow-control valves providing 16 different inlet-outlet flow direction combinations.



The knurling on the head of the screw permits faster assembly, because it provides a slip-proof grip.



The uniform depth and size of the hex socket assure maximum torque in wrenching. The accurate diameter of the head permits countersinking.



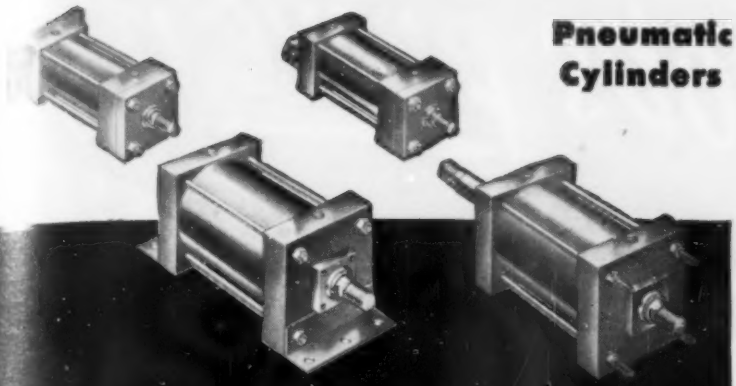
UNBRAKOs—made of heat treated alloy steel—have fully formed threads, Class 3 fit; controlled fillet and continuous grain flow for strength. Supplied in standard sizes from # 4 to 1".

Get personalized service, faster delivery with UNBRAKO Standards—stocked by your distributor

When you use UNBRAKO socket screw products, you get the finest socket screws made, *plus* the personalized service and the faster delivery of your local distributor. And he enables you to cut your inventory, set up more space for production. For more information, write for UNBRAKO Standards—a complete listing of precision socket screw products carried by your distributor. STANDARD PRESSED STEEL Co., Jenkintown 37, Pa.

UNBRAKO® SOCKET SCREW DIVISION SPS JENKINTOWN PENNSYLVANIA

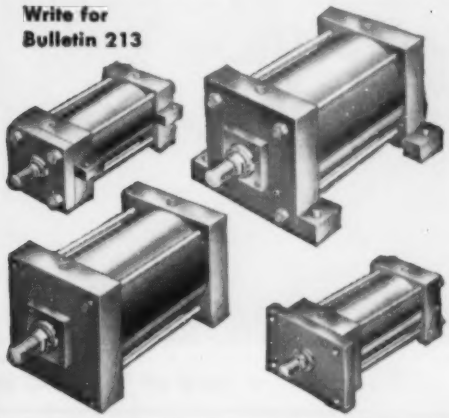




Pneumatic Cylinders

Hannifin Series "A" Square Type Pneumatic Cylinders are made in 11 bore sizes from 1½" to 14"...are available with 13 standard mountings, many combination mountings. All tooling is to extremely close tolerances to insure accurate, easy mounting. Cylinders are micro-honed and piston rods are ground and polished. Heavy-duty tie rods. Exclusive bronze cartridge gland is easily removed without dismantling the entire cylinder.

Write for Bulletin 213



NOW...

HANNIFIN HAS THE MOST COMPLETE LINE OF AIR CONTROL EQUIPMENT!

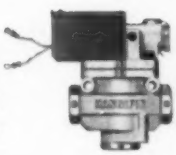
NEW! REVOLUTIONARY HANNIFIN *P-M Pilot-Master Valves*

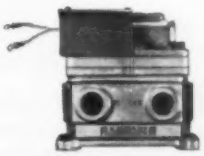
Piston-operated poppet design. Exclusive replaceable cartridge for easier maintenance. Speeds to 600 cycles per minute. Pressure from 15 to 150 p.s.i. Integral, solenoid-controlled pilot heads or a choice of 10 separate pilot valves for remote control.

- Fewer Valves to Stock
- Fewer Parts to Stock
- Maximum Interchangeability
- No Springs in Main Valve

Write for Bulletin 231.

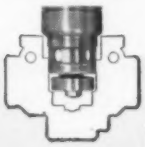
2 and 3-Way Valves.
Same valve operates 2-way or 3-way, normally open or normally closed. ⅜" to 1¼" I.P.S.



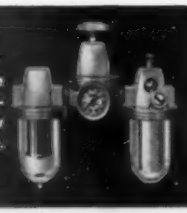


4-Way Valves.
Two 3-way valves mounted in compact, common body. Two piston poppets. Two cartridges. ⅜", ½", ¾" I.P.S.

EXCLUSIVE REPLACEABLE CARTRIDGE



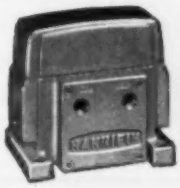
AIR WARDEN
Air filters, pressure regulators and lubricators to protect air operated equipment. Bulletin 10108.



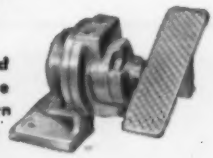
Disc Type Air Control Valves

Designed for smooth, positive and accurate control of air-operated equipment. Bronze discs lapped to perfect seal with seats. Packless design. For hand, foot or electrical operation. Sizes: ⅛" to 1¼" I.P.S.

Write for Bulletin 57-W



Hannifin "Directair" electrically controlled air-operated disc valve



Foot-operated treadle valve (Also spring return and rotary types)



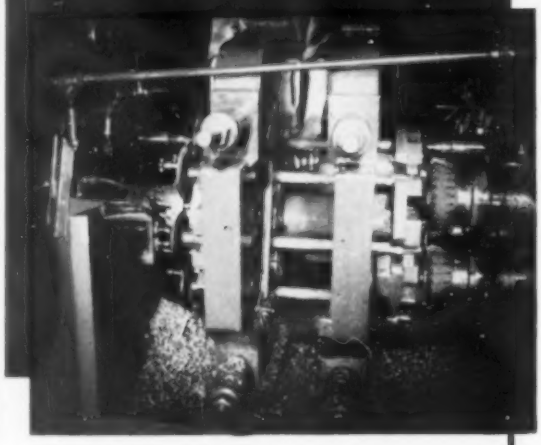
Standard hand control valve (Single or duplex)

HANNIFIN

Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

These jobs prove it!



ACTUAL JOB: Rough and finish mill spline end of rear axle shaft at large automotive plant.



Savings of over $14,225 per year on one machine with one set of Wesson tools

Old Method	New Wesson Method
Cost 1 set inserted blades....$48.00	Cost 1 set Inserted Blades....$54.[illegible]
Pieces per Grind.....275	Pieces per Grind.....16[illegible]
Grinding Hours per year. 10,300	Grinding Hours per year.....25[illegible]
5 Machines Running 3 Shifts	3 Machines Running 2 Shifts
Machine Repair per year $25,000	Machine Repair per year...$12[illegible]
Tool Cost per Piece.....$.00545*	Tool Cost per Piece.....$.00[illegible]

*(Machine repair and grinding costs not included)

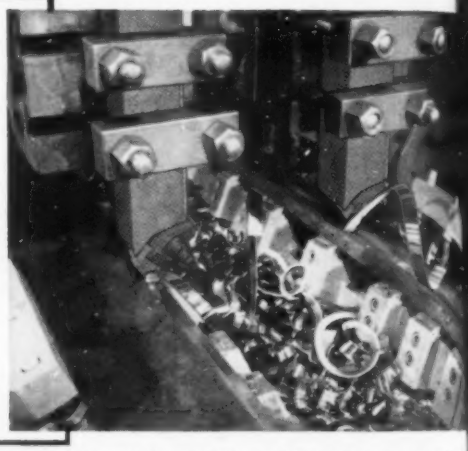
HOW IS YOUR PRODUCTION SCORE CARD?

ACTUAL JOB: Using Rockford planer to form cutting edge for a caterpillar bulldozer scraper blade.

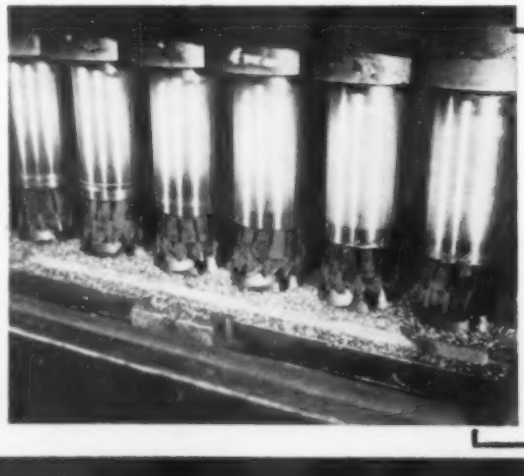


On only one machine with one Wesson tool savings of over $5900.00 per year

Old Method	New Wesson Method
Pieces per Grind.....½ to 1	Pieces per Grind.....13½
Total Tool Cost.....$49.25	Total Tool Cost.....$97.16
Average Pieces per tool life.....24 Pieces	Average Pieces per tool life.....324 Pieces
Cost per Piece.....$.60	Cost per Piece.....$.07



HOW IS YOUR PRODUCTION SCORE CARD?



ACTUAL JOB: Rough bore cylinder block on Ingersoll, 6 spindle, boring mill at large farm Implement Mfg. Co.



Over 300% dollar savings per tool

Old Method	New Wesson Method
Pieces per Grind.....836	Pieces per Grind.....3[illegible]
Cost of Tool.....$49.68	Cost of Tool.....$172.[illegible]
Grinding Cost per sharpening.....$11.70	Grinding Cost per Sharpening.....$8.[illegible]
Tool Cost per 100 Pieces.....$2.588	Tool Cost per 100 Pieces.....$0.6[illegible]

On *only* one machine with Wesson Tools Savings of over $900 per year

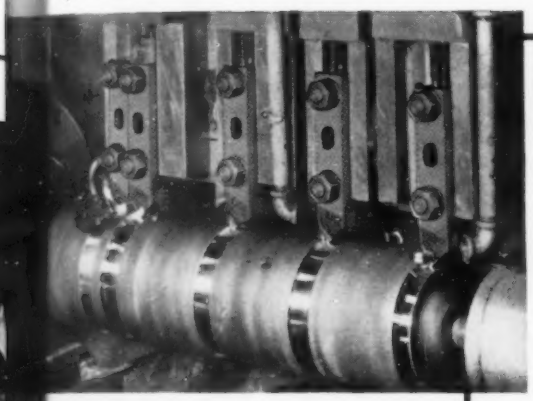
WESSON COMPANY

1220 WOODWARD HEIGHTS BLVD. FERNDALE (DETROIT 20), MICH.

WESSONMETAL
Carbide Blanks
A Tip To Quality

TOP PERFORMANCE
is possible only with
TOP TEAMWORK!

WESSON
Carbide Cutting Tools
ENGINEERED FOR CARBIDE



ACTUAL JOB: Rough turn hot forged 155 mm shells at Large Shell Mfg. Plant with Wesson Multicut Parallelogram Band Type Holder.



Another FIRST for WESSON with tool costs reduced by over 60% Production Increased 400%

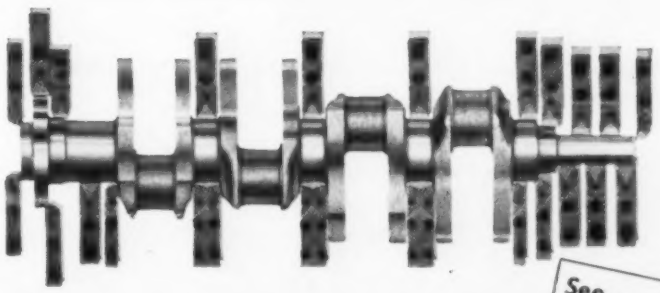
Old Method		New Wesson Method	
Tool Cost	$37.50	Tool Cost	$50.00
Useable Carbide	3/8"	Useable Carbide	9/16"
Average Pieces per Grind	60	Average Pieces per Grind	60
Pieces Machined per Tool	420	Pieces Machined per Tool	1680
Tool Cost per Piece	8.1c	Tool Cost per Piece	2.9c
Down Time for Tool Change	15 min. every hour	Down Time for Tool Change	4 min. every hour

HOW IS YOUR PRODUCTION SCORE CARD?

ACTUAL JOB: Crankshafts being turned for first time at large Automotive Plant with Wessonmetal solid carbide inserts in Wesson Multicut Band Type Tool Holders.

Here's Outstanding Performance! An average of 9000 pieces per insert before sharpening

Old Method	New Wesson Method
Pieces.....11 per hour	Pieces.....48 per hour
Cycle time.1 min. 55 seconds	Cycle time....40 seconds
Cranks per tool change (average)....1.7 pieces	Cranks per tool change (average)..1500 pieces



Call The Wesson man in your area. Ask him about the many Wesson Case Histories.

See "THIS CARBIDE AGE" educational color-sound movie on the history of carbide

WESSON METAL CORPORATION

LEXINGTON 34, KENTUCKY

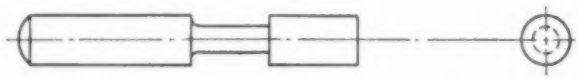
Swaging Success Stories



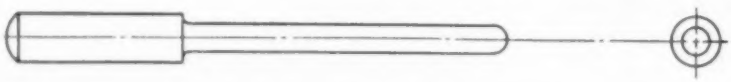
Close Tolerances... without Machining



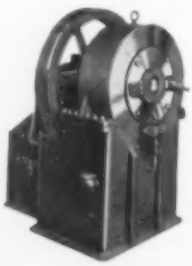
This finished piece used to be made on an automatic screw machine with the long, narrow diameter section turned to .100 ±.003 and a necessary sharp shoulder.



Torrington's swaging experts suggested starting with this simple screw machine blank (to retain the required shoulder).



Result after one rotary swage—an improved finished piece, to a tolerance of ±.001.



THE TORRINGTON COMPANY
Swager Department
444 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

Why not write for our informative booklet on swaging that includes complete descriptions of Torrington Rotary Swagers. It may show you how you can achieve a "swaging success story" in your own plant.

See what savings you can make by swaging

1. Saving in material—swaging uses nearly all the metal.

2. Saving in time—swaging is fast.

3. Saving in labor—unskilled labor can run a swager.

4. Saving in machining—swaging produces finishes accurate to ±.001.

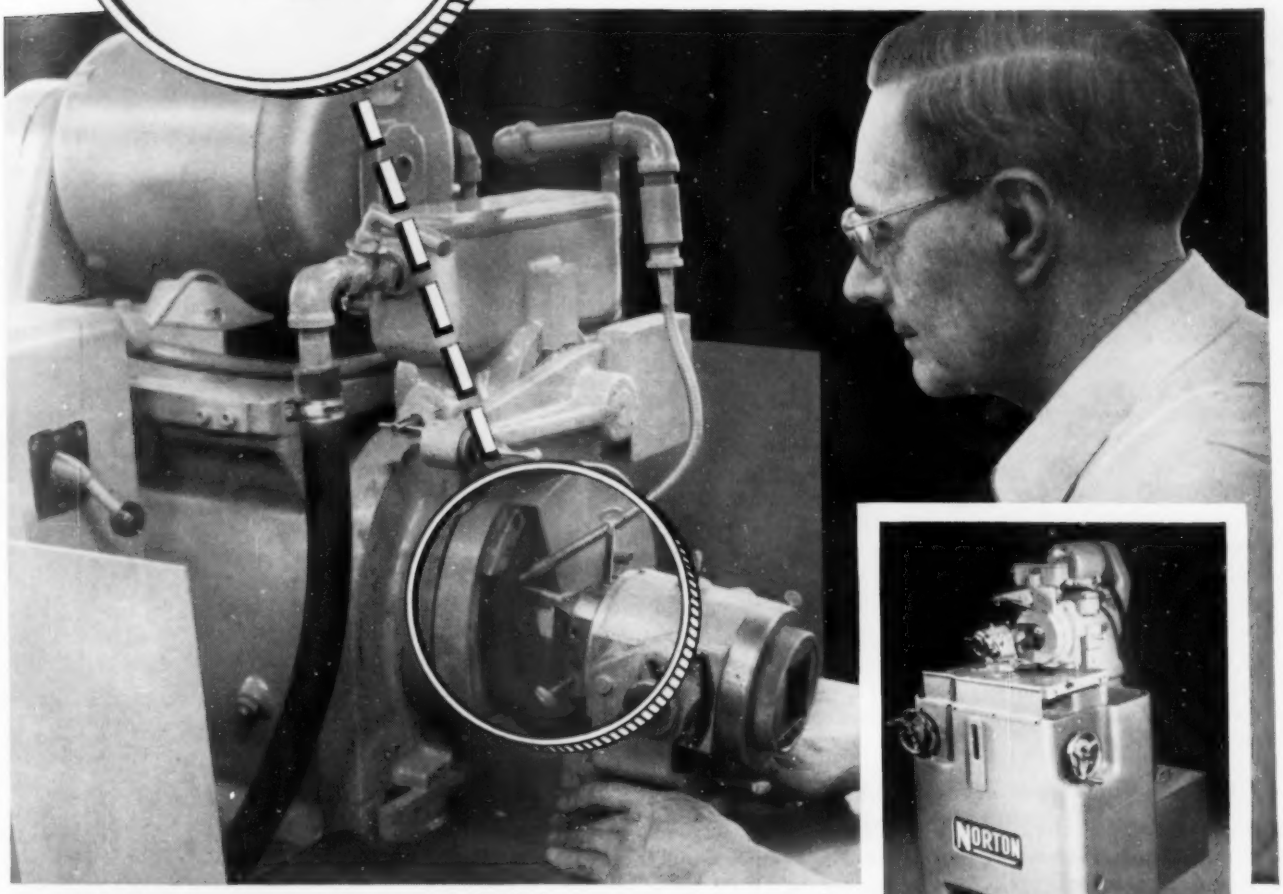
5. Saving in finishing operations—swaging produces high finish, better hardness and resiliency.

TORRINGTON ROTARY SWAGING MACHINES

Unequalled

for carbide tool sharpening, the Norton No. 2 Bura-Way Grinder...

makes tools last longer



BURA-WAY does it better. This Norton Tool Grinder for convex single point and form tools: (1) generates, reproduces and maintains relief angles *constant in the direction of feed*, providing uniform support to the cutting edge and; (2) insures exact duplicates of the master tool form.

When your operator sharpens your carbide-tipped tools on the Norton No. 2 BURA-WAY Grinder he adds longer life value to these tools, helping you to make more profit and turn out better products for your customers.

Precise Duplicates Every Time

In the BURA-WAY No. 2 you have the ideal tool grinder. The BURA-WAY method increases tool life and gives you more pieces per sharpening. By exact duplication of the master tool, tremendous additional benefits may be realized from an effective tool control system and reduced set up time when changing tools.

Find Out More

Get in touch with your Norton representative whose knowledge and experience is further supplemented by Norton trained engineers. Only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost.

Write NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

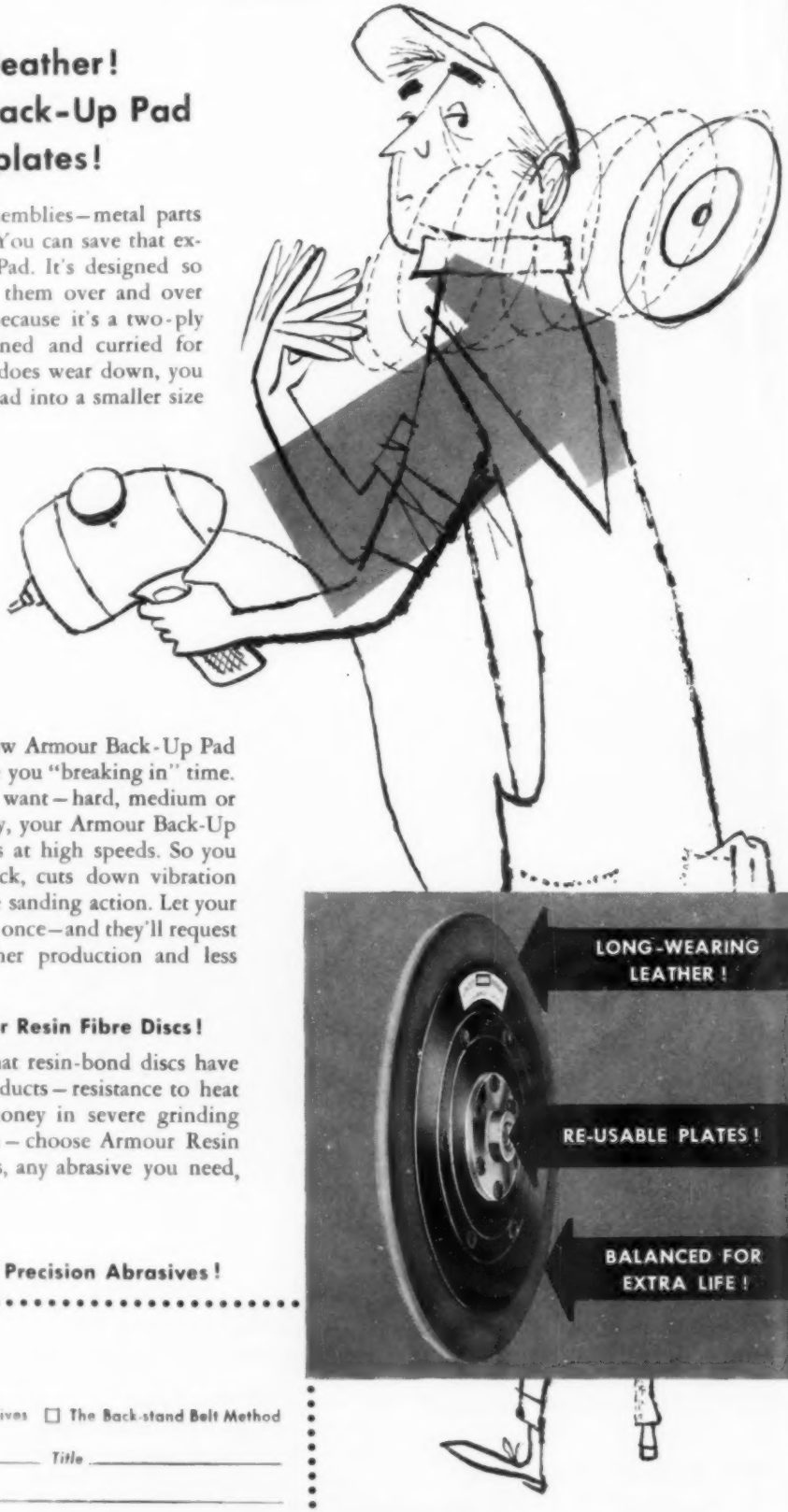
Making better products... to make other products better

District Sales Offices:
Hartford • New York • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

Don't throw away that back-up pad!

Just replace the leather! It's the new Armour Back-Up Pad with re-usable plates!

Are you throwing away your back-up assemblies—metal parts and all—when just the pad wears out? You can save that expense with the new Armour Back-Up Pad. It's designed so you can detach the steel plates and use them over and over again! The pad will last longer, too, because it's a two-ply construction of the finest leathers, tanned and curried for resistance. And when the leather finally does wear down, you can save money by cutting the Armour pad into a smaller size—it's as good as new!



Another money-saving feature of the new Armour Back-Up Pad is that it's tailored at the factory to save you "breaking in" time. You can even order the flexibility you want—hard, medium or soft! And to guarantee perfect flexibility, your Armour Back-Up Pad receives four precision-balance tests at high speeds. So you can be sure that your pad absorbs shock, cuts down vibration and provides the disc with smooth, safe sanding action. Let your workmen test this precision-balance pad once—and they'll request Armour Back-Up Pads always for higher production and less operating fatigue!

Use these new pads with Armour Resin Fibre Discs!

Actual production tests have proved that resin-bond discs have two big advantages over glue-bond products—resistance to heat and resistance to moisture. So save money in severe grinding operations and edge-wear grinding jobs—choose Armour Resin Fibre Discs! And for belts, rolls, sheets, any abrasive you need, call on Armour today!

Learn more about Armour's Precision Abrasives!

ARMOUR AND COMPANY,
North Benton Road, Alliance, Ohio

Please send me free booklets on:

☐ Armour Back-Up Pads ☐ Storing Abrasives ☐ The Back-stand Belt Method

Name _____ Title _____

Firm _____

Address _____

City _____ Zone _____ State _____

T-8

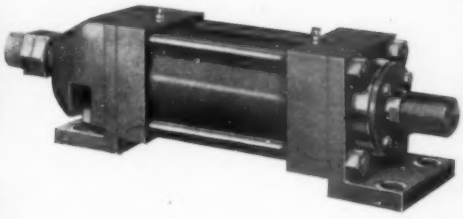
ARMOUR *Coated Abrasives*

Armour and Company • Alliance, Ohio

AUTOMATION

Realistic Planning

CALLS FOR PRACTICAL EXPERIENCE

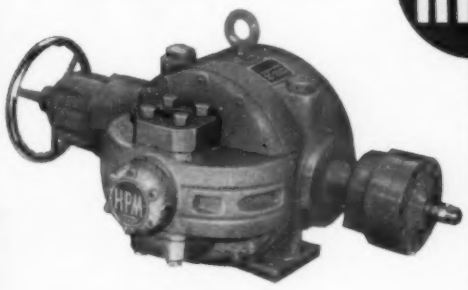


AIR AND OIL
HYDRAULIC CYLINDERS



AUTOMATICALLY
CONTROLLED VALVES

HPM



VARIABLE VOLUME
HYDRAULIC PUMPS



PACKAGED POWER UNITS

For over three-quarters of a century H-P-M engineers have designed equipment — and motions — for varied requirements. Now, with a complete line of air and hydraulic components as part of our standard line you are assured of complete responsibility for your automatic systems. The hydraulic cylinders, valves, pumps and power units illustrated are typical of the air and oil hydraulic equipment in the H-P-M line. Call in the H-P-M Field Engineer in your locality when power, or the control of power, is your problem. The experience of the H-P-M organization will be of real assistance.



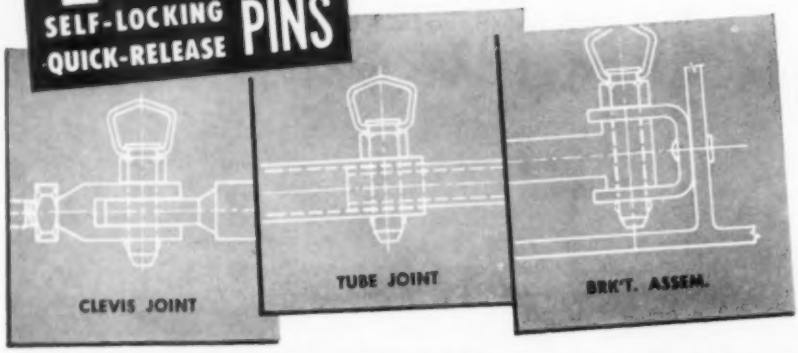
This 28-page condensed catalog covers the complete H-P-M line of hydraulic components. Write for your copy.

HPM

HYDRAULIC
POWER
DIVISION
THE HYDRAULIC PRESS MFG. CO.
MOUNT GILEAD, OHIO, U. S. A.

pip
SELF-LOCKING QUICK-RELEASE PINS

the *One Unit* answer for every IMPORTANT LOCK-PIN PROBLEM!





FAST • ECONOMICAL • DEPENDABLE IN BLIND OR OPEN APPLICATIONS!

The patented push-to-insert, pull-to-remove principle of PIP double acting pins provides quick release and positive self-locking safety in a single unit. No cotter pins, nuts, bolts or other separate retaining items or assembly tools are required or need enter into your design specifications! PIP pins offer faster assembly speed, versatility and economy and are available in most diameters and lengths to usual bolt standards or can be manufactured to your specifications. Write for PIP details today!

PIP'S PATENTED FEATURES APPROVED BY LEADING ENGINEERS!
Write for illustrated PIP pin folder showing working details, sizes and specifications.

an accepted part in industrial, military and aircraft designs –

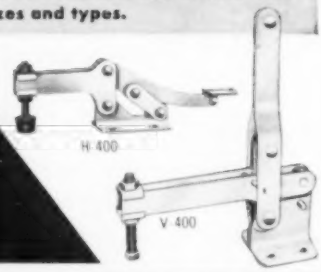
AVIATION DEVELOPMENTS INC. PIP 210 NORTH FRONT STREET • BURBANK, CALIFORNIA

AVIATION DEVELOPMENTS (CANADA), LTD., TORONTO • AVIATION DEVELOPMENTS, LTD., LONDON, ENGLAND

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-180-1

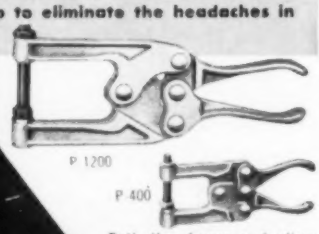
TOGGLE CLAMPS With added valuable feature — now offered to you as part of the broad line of KNU-VISE Toggle Clamps—in many sizes and types.

they're **NON-CORROSIVE!**
they're **NON-MAGNETIC!**
they're of **STAINLESS STEEL!**



TOGGLE PLIERS Here is the KNU-VISE answer to your need for a portable clamp to eliminate the headaches in spot welding aluminum.

they're **NON-MAGNETIC!**
they're **NON-CORROSIVE!**
they're of **K-MONEL!**
(stronger than steel)



Both the clamps and pliers are also available in aluminum, on special request.

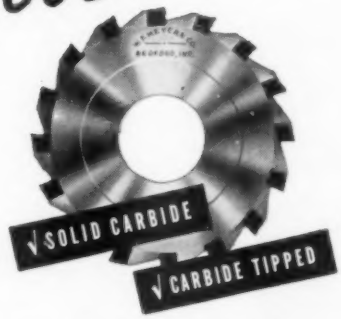
Sales offices in principal cities—Teletype DE 49

KNU-VISE PRODUCTS **LAPEER MFG. CO.**

3053 DAVISON ROAD • LAPEER, MICHIGAN
WESTERN DIVISION: 422 MAGNOLIA, GLENDALE, CALIF.
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INDICATE A-8-180-2

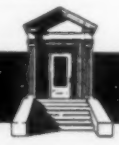
PRECISION CIRCULAR CUTTERS



MEYCO carbide tipped and solid carbide cutters have earned an enviable reputation in plants where long tool life and precision workmanship is a MUST.

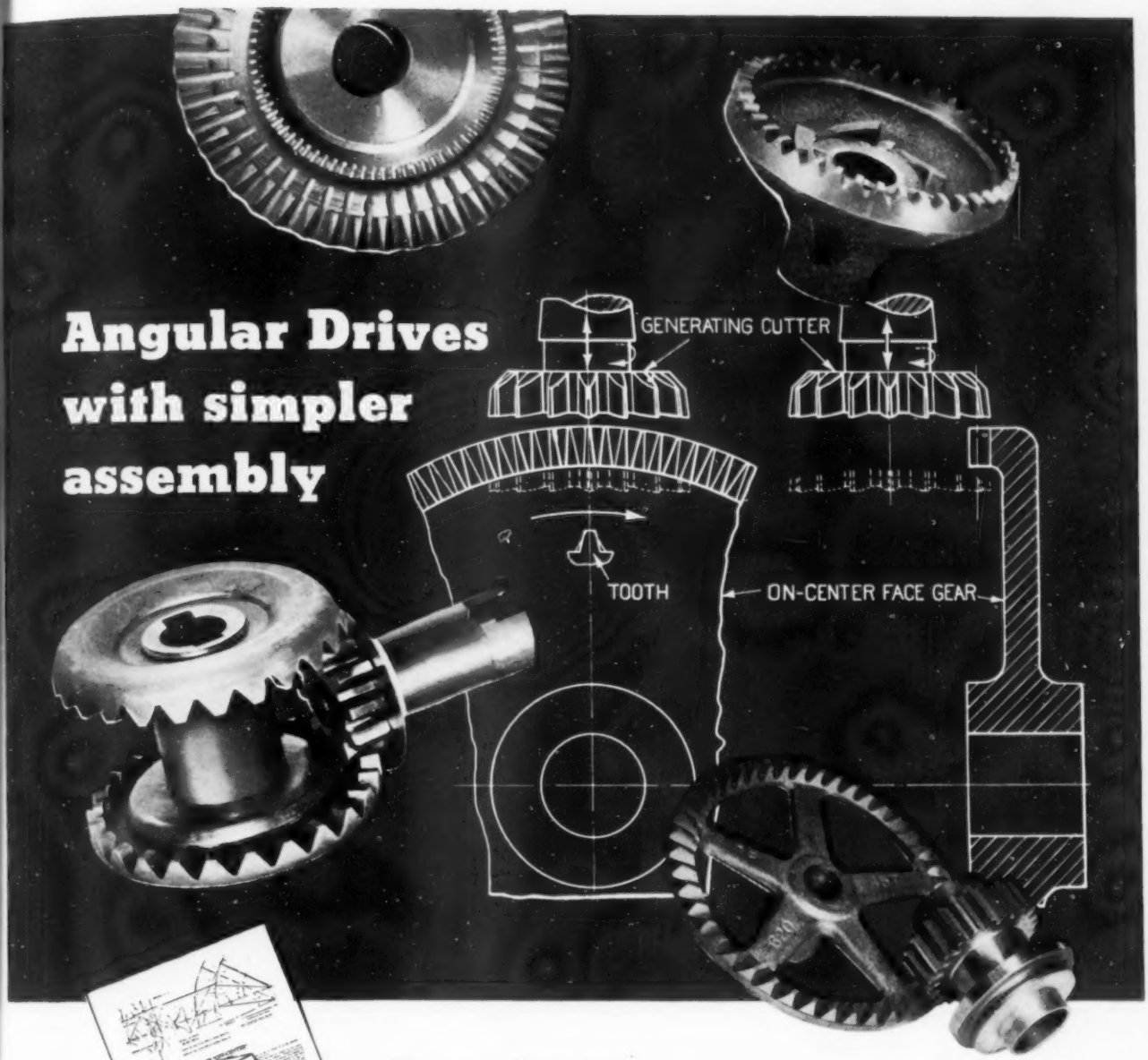
These cutters can be furnished in various diameters and thicknesses to meet the requirements of individual applications.

Saws and cutters, both carbide tipped and solid carbide, will aid production and precision in your slotting, venting, slitting and grooving operations . . . and they will be manufactured to your specifications. Please furnish complete specs and quantities desired when requesting prices and indicate material to be cut. MEYCO experience in the manufacture of precision tools, since 1888, is at your disposal.



W. F. MEYERS CO., INC., BEDFORD, INDIANA

INDICATE A-8-180-3



Angular Drives with simpler assembly



Special instruction sheets for determining the active face width of both 'on-center' and off-center' face gears will be sent free of charge. Copies may be obtained by writing the nearest Fellows office.

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Both face gear and pinion can be produced with great accuracy on the Gear Shaper, and at costs so low that designers prefer face gears for many angular drives. A special bulletin of principles and applications of face gears is yours for the asking.

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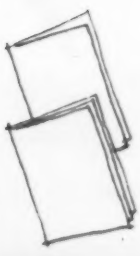
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From 85 pieces per hour to 130 pieces per hour

EDLUND engineered drilling and tapping machines can solve your drilling problems

PROBLEM: To Manufacture 1820 parts in a two shift day, where the drilling operation was the bottleneck.
Material: Medium Cast Iron
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OLD METHOD: Drill one Sprocket at a time in lever type fixture using multi-head and step drill for reamed hole.

NEW METHOD: Drill two sprockets at a time using Edlund 2F-8" Power Feed 2-Spindle Drill on a 3-spindle base A Drill Plate Type Fixture held the Sprocket.

RESULTS: Production of 1820 pcs. in 14 hours using the Edlund 2F, compared with 23 hours using the old method. Drill life was increased because of more accurately controlled speed and feed.



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Cortland, N. Y.

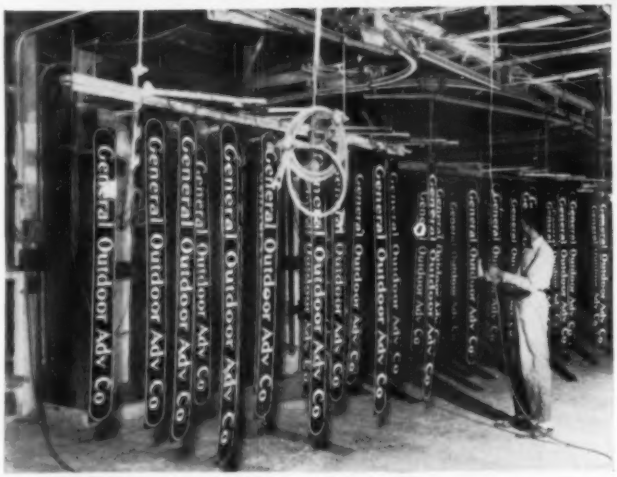
- ☐ Send me Bulletin 140 on the Edlund 2F.
- ☐ Have a representative call ☐ immediately ☐ when convenient

Name_____

Company_____

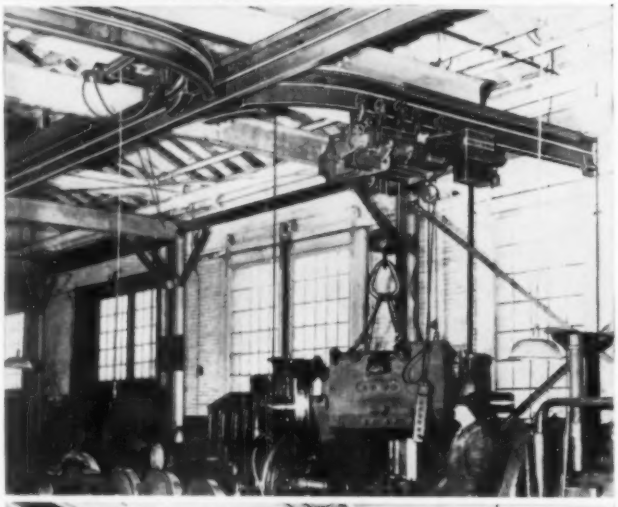
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what MONORAIL can do . . .



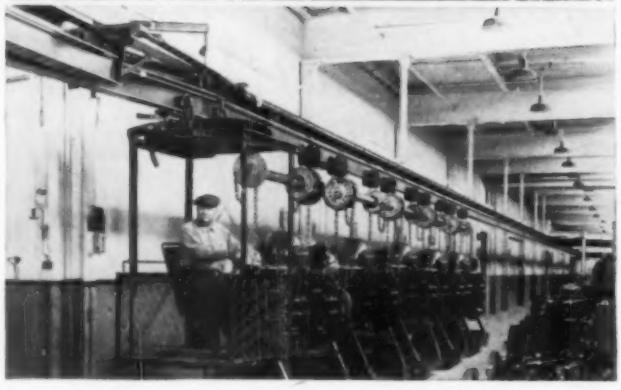
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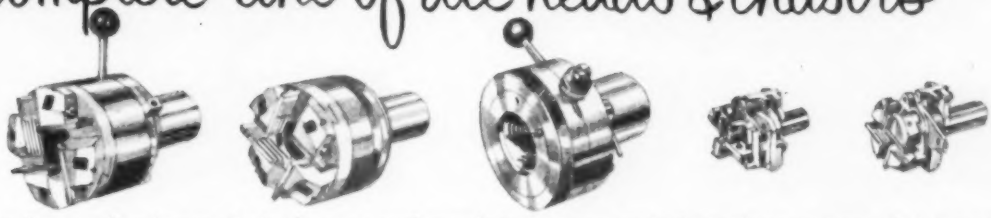
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AMERICAN MONORAIL COMPANY

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Jones & Lamson offers...

a complete line of die heads & chasers



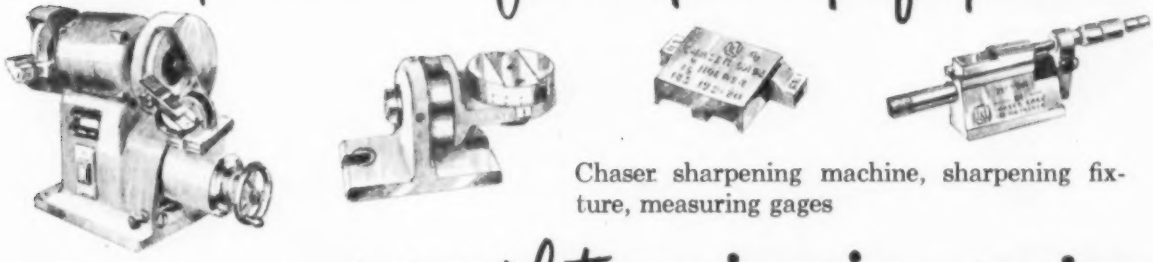
Automatic opening tangent stationary and revolving types, radial stationary type, B&S and small turret lathe types

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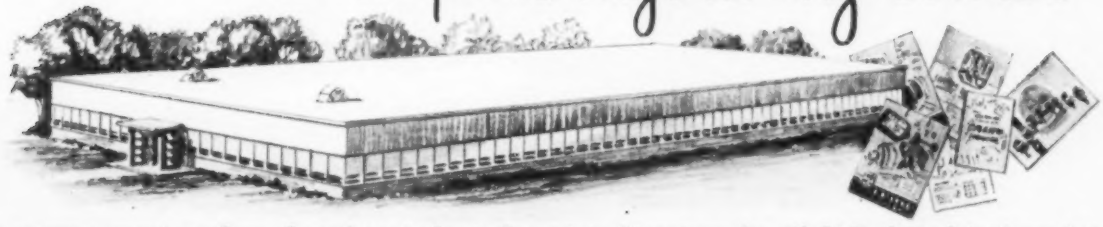
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Chaser sharpening machine, sharpening fixture, measuring gages

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World's newest, most modern thread tool plant. Complete literature for all J&L thread tool products

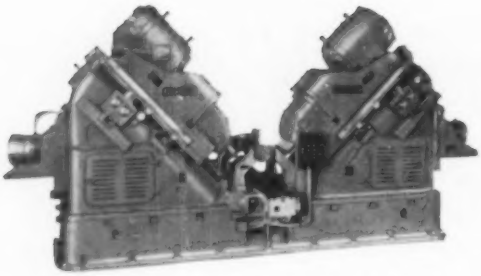
P.S.

J&L Automatic Opening Die Heads and Chasers assure: low initial cost — ease of operation — controlled resharpening — use of carbide where applicable. Class III threads guaranteed. This means important savings regardless of your tolerance requirements. Write to Dept. 710 for complete information.

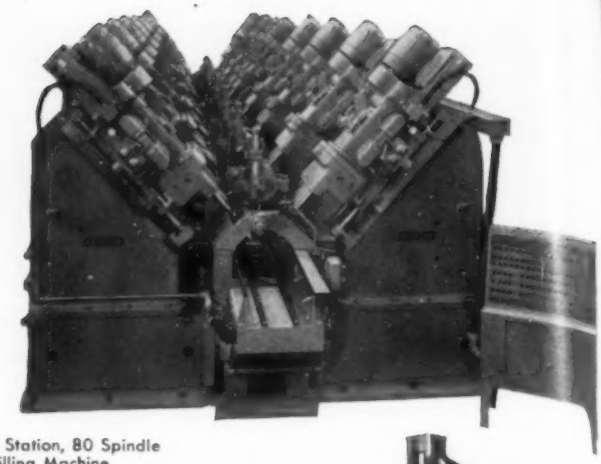
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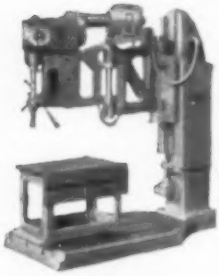
JONES & LAMSON MACHINE CO., 518 Clinton St., Dept. 710, Springfield, Vt., U.S.A. J&L THREAD TOOL DIV.



Two-Way Hydraulic Feed
Vee Type Stub Boring Machine



17 Station, 80 Spindle
Drilling Machine



Unique Bracket Type Hammond
Radial Drilling and Tapping Machine

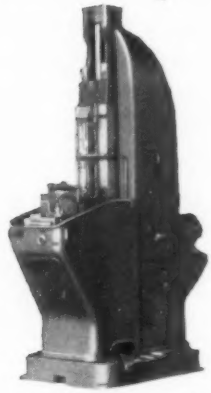
FOOTBURT

line of production machines

• Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways... Station Type Machines . . . Center Column Type Machines... Cylinder Boring Machines... Inverted Drilling Machines . . . Surface Broaching Machines . . . Sensitive Drilling Machines . . . Hammond Radial Drilling Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . . Special Machines.

THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

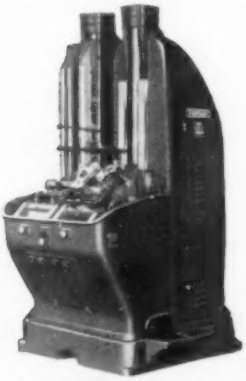
Detroit Office: General Motors Building



Single Slide Broaching
Machine 5, 10, 15 and 25 Ton
capacity



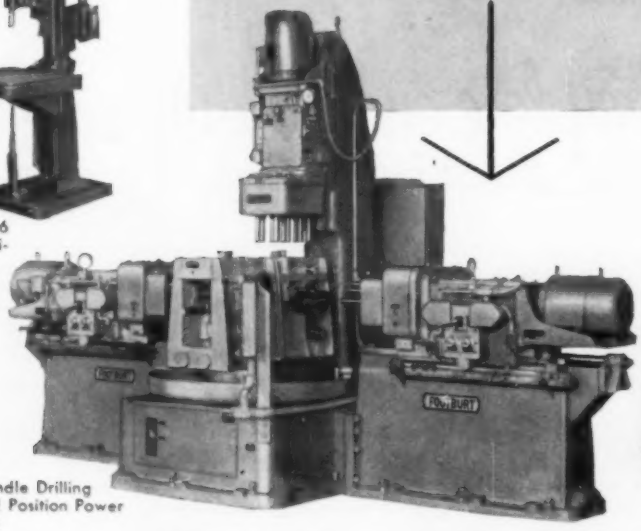
Stub Type Cylinder
Boring Machines



Duplex Surface Broaching
Machine 5, 10, 15 and 25 ton
capacity



1, 2, 3, 4 and 6
Spindle Sensi-
tive Drilling
Machines



3-Way 31 Spindle Drilling
Machine with 2 Position Power
Indexing Table



Continuous Type Broaching
Machine Built in Five Sizes

engineered for production

FOOTBURT

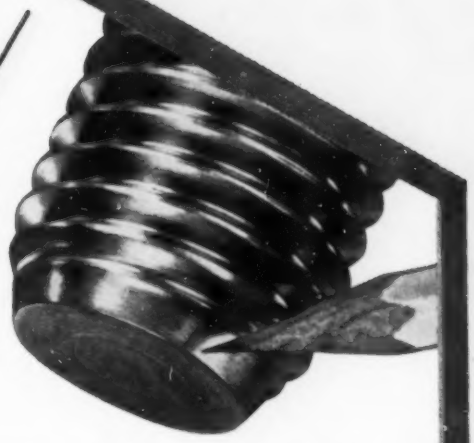
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OFFERS YOU

THE LEADER POINT



Allen's unthreaded Leader Point permits easier starting, reduces the possibility of cross threading, protects threads from damage if the screw is accidentally knocked or dropped. Your Allen Distributor stocks the largest range of sizes in 18-8 stainless cap screws available anywhere . . . 97 standard sizes #4 x ¼" to ⅝" x 3" with NC threads; #10 x ⅜" to ⅜" x 1½" with NF. Be sure to specify genuine Allen Leader Points.

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MANUFACTURING COMPANY

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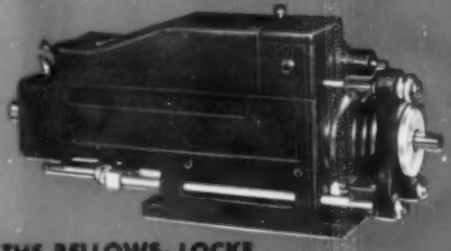
To Help You Get More Production at Less Cos



THE BELLOWS DRILL PRESS FEED
to convert manually fed drill presses to automatic machines



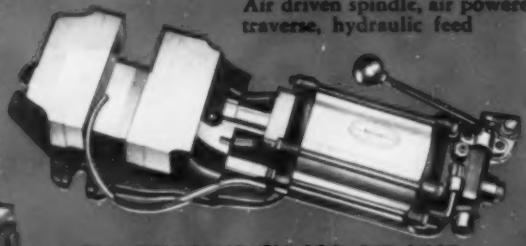
THE BELLOWS ROTARY FEED TABLE
to feed parts to tools, quickly, safely, automatically



THE BELLOWS- LOCKE DRILL UNIT
Electrically driven spindle, air-powered traverse, hydraulic feed



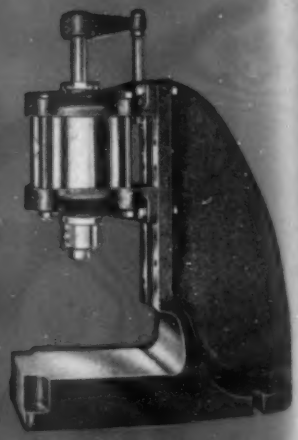
THE BELLOWS HYDRAIR DRILL UNIT
Air driven spindle, air powered traverse, hydraulic feed



THE BELLOWS CV-40B AIR VISE
A ready made jig for handling small parts



THE BELLOWS TRANSFEED
a two position work feeder — operator loads and unloads while work is going on



THE BELLOWS ARBOR PRESS
For fast, safe, light pressing or stamping



THE BELLOWS INFEED ATTACHMENT
to speed production, lessen operator fatigue, reduce rejects in centerless grinding

THE BELLOWS DVH-150 VISE
Air-Hydraulic Vise for milling machine operations



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WRITE FOR BULLETIN CL-50 TODAY . . ADDRESS DEPT. TE 854

You can sharpen

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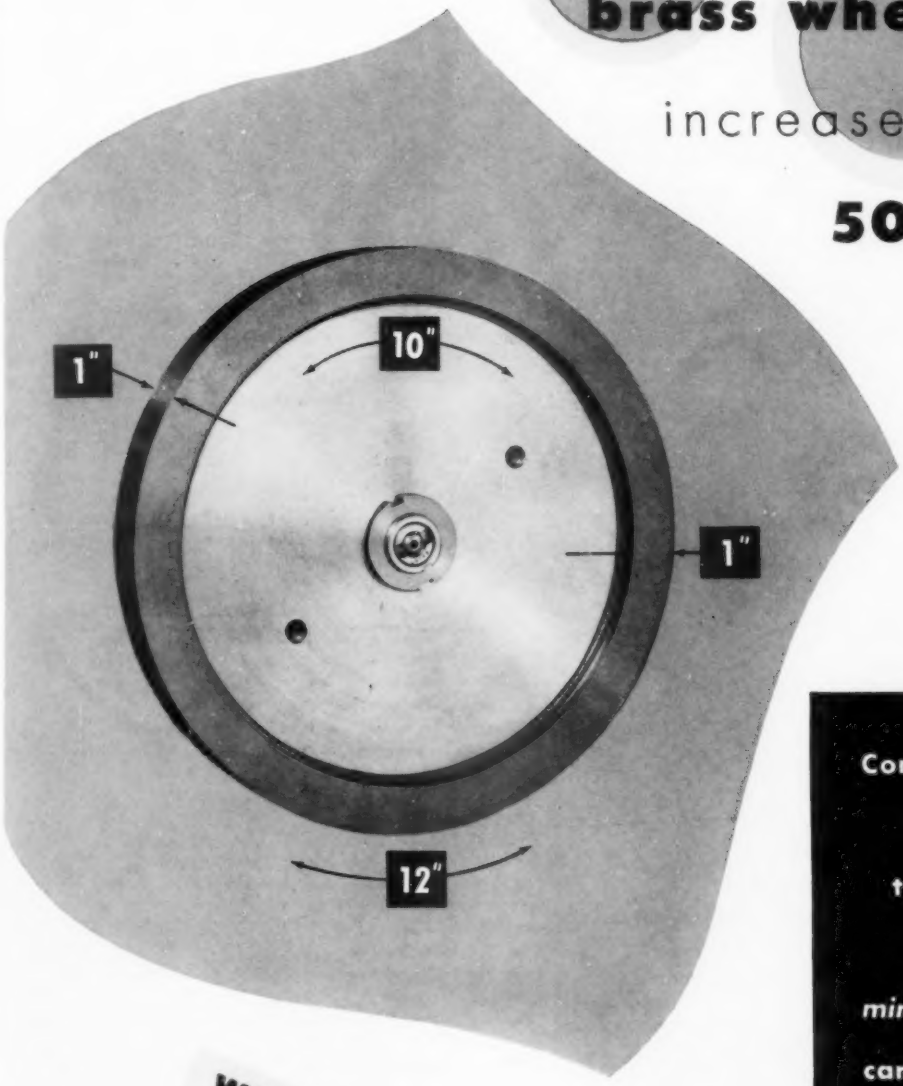
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insert tools with this $45

brass wheel and

increase tool life

50 to 200%



Ave. cost per tool sharpened:

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Convert from abrasive and diamond wheels to an Elox brass wheel and save *50 minutes* sharpening 20 carbide insert tools.

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High Precision, Reliability, Top Performance

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SCHAERER MODEL UN-450
HEAVY DUTY
COPYING LATHES.

Twin cross slides. Copies from cylindrical or flat template either longitudinally or cross. Twin slides permits rough turning and finish turning in the same operation in many instances. Swings 17-3/4" over bed, 9" over carriage, 20-5/64" over gap. Center distance 60". Spindle speeds 31.5 to 1400 R.P.M. Hydraulic copying attachment can be removed to permit use as a regular twin slide lathe when necessary. 10 H.P. motor drive to spindle. Separate motors for coolant and hydraulic pump. A production lathe built to tool room standards.

OUTSTANDING FEATURES

Copies simultaneously in 2 directions; 49 longitudinal and cross feeds; All gears in headstock hardened and ground; Automatic carriage release when overloaded; Separate oiling systems for front and rear end bearings; Ball stop catch on cross slide guarantees accurate depth adjustment for thread cutting; Adjustable carriage stop for longitudinal turning.

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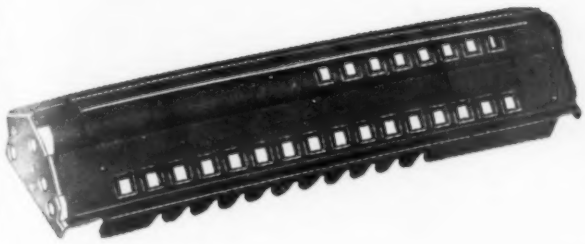
Our headquarters in New York City



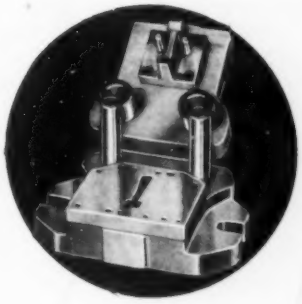
MBI

PRODUCTO *Catalog* DIE SETS

SOLVE SPECIAL STAMPING PROBLEM FOR MONROE



The Problem:
Stamping end-plate holes in the carriage cover of the Monroe Adding Calculator.



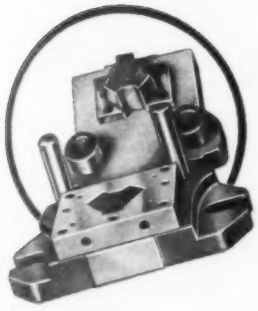


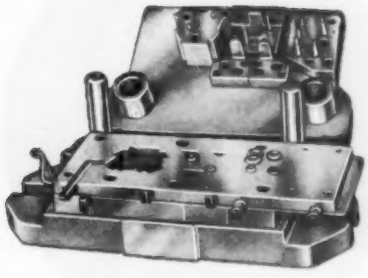


PRECISION

PRODUCTO

New design





THE DIE MANUFACTURER:
The Connecticut Tool and Engineering Co., Bridgeport, Conn.

The lofty die, at right, represents the last critical stamping operation in the production of the Monroe carriage cover, shown above. It's unusual because it pierces close-tolerance end holes in either 10" or 12" covers *after* they have been assembled. The die set that controls this precise piercing operation both looks and performs like a "special" made-to-order set. Actually, it is a rear pin catalog set fitted with 1¼" x 16" pins. Even with the long guide pins, the highly accurate parallelism is maintained. Yes, Monroe is getting the benefit of a "special" without paying for extras in time and expense.

In all, 12 Producto catalog die sets are used in stamping and forming this assembly. Only the one with the long guide pins is unusual in size or shape but *all* require the utmost in precision and dependability. The point to remember is this: Whether you require a "made-to-order" special or a "quick-to-order" catalog die set, you'll get the *best* from Producto.



FOR PRECISION DIE SETS *FAST* CALL...

THE PRODUCTO MACHINE COMPANY • 930 Housatonic Ave., Bridgeport 1, Conn.

ALSO MAKERS OF DIE ACCESSORIES, FEEDING EQUIPMENT, VISES, MACHINERY. 2PD54A

SAVE UP TO 85% ON GOVERNMENT SURPLUS

MAGNI-FOCUSER

Has fine ground lenses of optical glass. Neutralizes eye strain from close work. Binocular design gives third dimensional vision. Allows freedom of both hands. Wear over glasses. Plastic frame with adjustable headband.

SIZES: 20" focal lgth. 1½ power — 14" focal lgth., 1¾ power, 10" focal lgth., 2½ power; 8" focal lgth., 2¾ power . . . . . price each ONLY 10.50

OTC TOOLS

See our complete line. Pullers for Gears, Bearings, Wheels, Pulleys, Bushings, Shafts, etc.

NEW 10 TON HYDRAULIC PRESS

SIZE: 60" high 27" wide 29" base

Use this Press in the Shop or take it with you on the job. Frame is 4" welded channel iron. Has 4¼" stroke, 2½" diam. ram. Valve operates piston in both directions. Adjustable platform. Positive power Hand Pump with handle. 2000 PSI pressure gauge. 129.00

HYDRAULIC EQUIPMENT

We stock over 100,000 Hydraulic Cylinders in 106 different types and sizes. These can be adapted wherever tremendous power is needed to push, pull, hoist, mould or drive, etc.

SPECIAL

Gives 20,000 lb. thrust using 1500 PSI line-pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lb. thrust with 3000 PSI. Can also be used on a low pressure air system. Has 4" bore; 18" stroke; 30½" long. Ideal for shop.

Part No. 29 USED 29.95 NEW 43.95

HYDRAULIC HAND PUMP

Operating pressure 1500 PSI. Cap., 1.5 cu. in per complete cycle . . . 12.75

ACCUMULATORS

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A-2B FLOATING PISTON TYPE — 4"x 18" Built to stand 2,000 PSI 12.75

A-5 VICKERS — 10" dia. Ball type. Built to stand 2000 P.S.I. 24.50

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They are terrifically popular because the six staggered cutting edges are scientifically designed to give a shearing cut and thus eliminate all chatter.
Made in 12 sizes in all degrees; also supplied as sets in strong Kit-cases.

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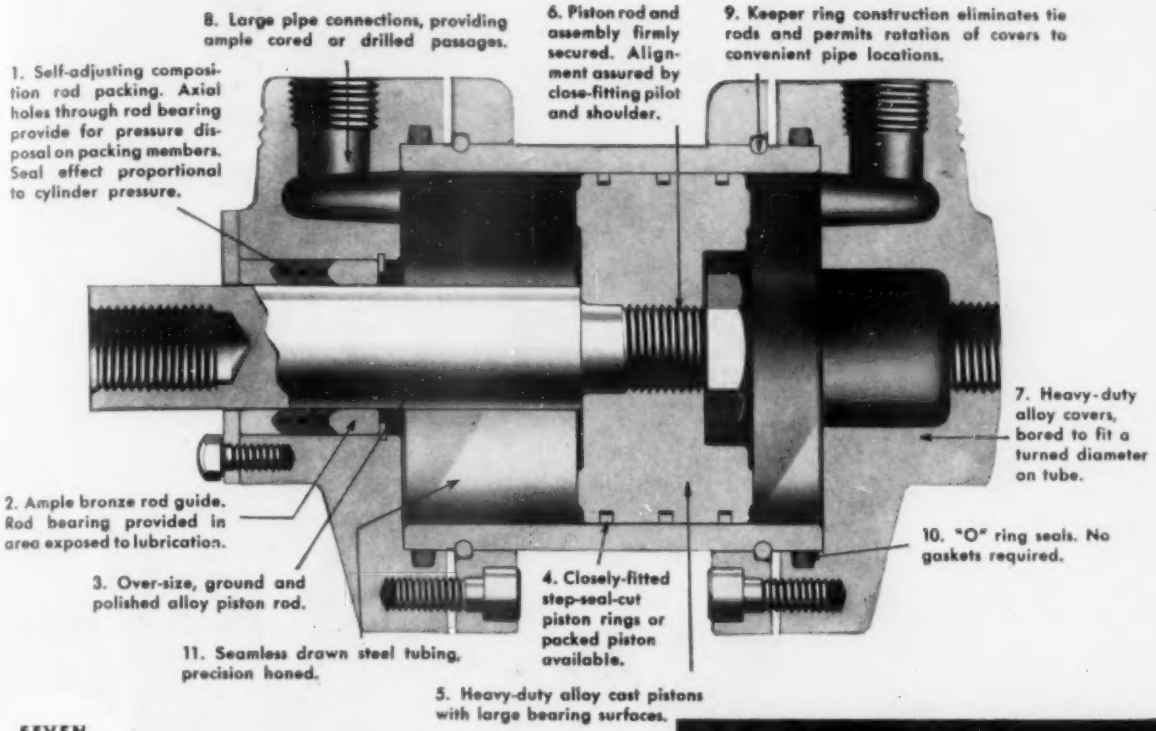
Twenty-three models for all types of work. 4" swing, Bed Length 12" or 18"; over 100 stock sizes of collets from .004" to 5/16".

Send for Catalog L describing Lathes for tool work, second operations; turrets and full line of accessories.

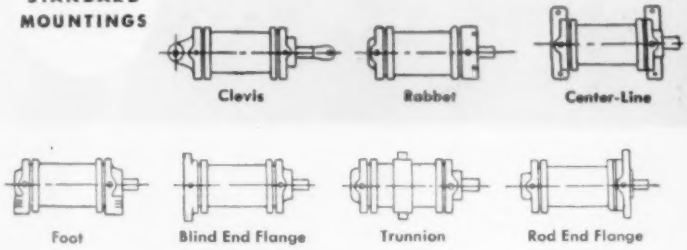
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..with RIVETT HYDRAULIC CYLINDERS

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50 THROUGH 300-TON CAPACITIES

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For a realistic answer to the metal stamping and forming problems of today... and tomorrow

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Fully streamlined, enclosed construction, front and back, provides pronounced advantages. There are no exposed, overhanging flywheel, clutch, brake, intermediate shaft, nor motor in rear of press to obstruct crane service, block light, throw grease and consume floor space unnecessarily ... yet all parts are quickly accessible.

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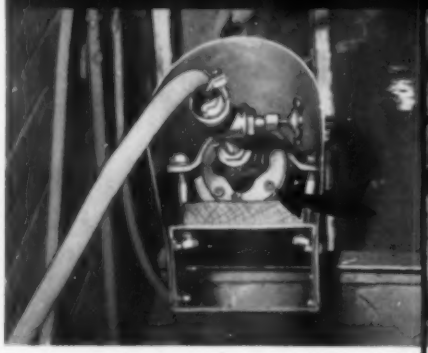
STRAIGHT SIDE DOUBLE CRANK PRESSES

With KELLER AIR MOTORS you get...

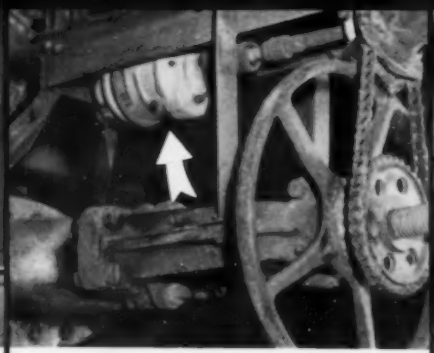


KELLER PISTON-TYPE AIR MOTORS are engineered to afford maximum power in small units . . . with a high power-to-weight ratio. Reversible operation and infinitely variable speed (from zero to full rating) provide complete control. Keller Air Motors cannot "burn out" from overload, and they are nonsparking for safety.

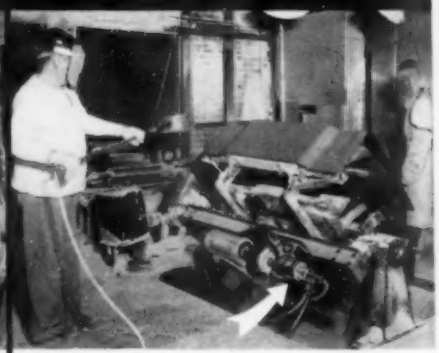
WRITE FOR CATALOG SECTION NO. 70 for detailed information



Keller Air Motor used to drive the impeller for agitating enamel in a dip tank.



This air motor operates a 14" valve in an oil refinery where safety is a must.



Keller Air Motors power tilt-turn-table for enameling red-hot bathroom fixtures.

Keller Tool Company • 1311 Fulton Street, Grand Haven, Michigan



British Jets via BAUSH AUTOMATION

The Baush Vertical Dual Column Quill Feed Cam Unit Machine illustrated was designed and built to do one job, and one job ONLY, on British Jet parts:

To drill and ream a total of 97 holes, .220" diam. on an 18.946" diam. bolt circle through a double flange in stainless steel Compressor Rotor Wheels, without being touched by the operator.

Each of these Baush units is furnished with a single spindle—one unit for drilling and one unit for reaming. Automatic hydraulic indexing fixture with stationary bushings guides drills and reamers.

Once the part is loaded into fixture and machine is started by operator, the cycle is completely automatic until all 97 holes have been drilled and reamed.

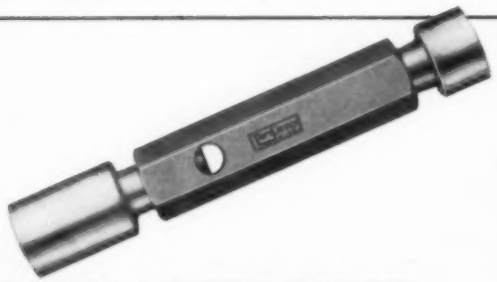
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MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

TIPS FROM TAFT-PEIRCE ON:

How to Gage a Hole



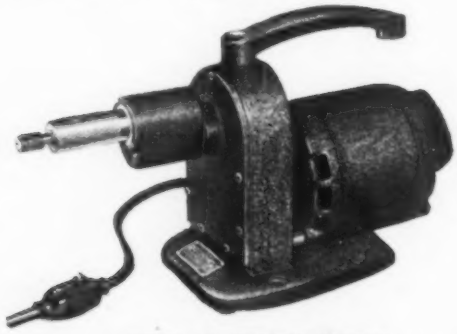
IF IT HAS A SIMPLE DIAMETER

T-P Plain Plug Gages save you money where small quantities are involved or where initial investment must be held to a minimum. Furnished in a wide range of materials, there's a gage for every problem — in hardened tool steel — Electrolized for longer wear —Carbide, Norbide, or Chromium Plated for exceptional resistance to abrasion or scratching. Emmerton Ball Bearing Pilot Plugs can be provided to eliminate end-wear and scoring of soft materials.



IF IT HAS A THREAD

T-P Thread Plug Gages come in a wide variety of styles and materials. Like T-P Ring and Snap Gages, they're available in alloy tool steels, Electrolized, Carbide, Norbide, or Chrome-Plated. This allows you to pick the best combination of cost and wear-resistance for the job.



ADD A ROTOCHEK

For Greater Speed in checking threads. Push — and the gage screws into the work. Release the pressure and it stops. Pull — and it disengages. Ideal for mass production. Operators report it doubles to triples inspection rates.



CHECK THE GAGE FOR ACCURACY

T-P Precision Gage Blocks are the ultimate in accuracy. They provide a dependable master against which to check your production gages. Furnished in small or large sets capable of measuring increments down to 0.00005″. Carbide Wear Blocks are also available to increase the life of your set.

THE TAFT-PEIRCE MANUFACTURING COMPANY

A T-P COMPAIRATOR AIR GAGE

For Greater Speed, Accuracy, Simplicity, and lower maintenance costs. Permits checking diameters from end to end, exploring the work for conditions of taper, out-of-roundness, bellmouth, and other variations. Measures internal diameters as small as .055".



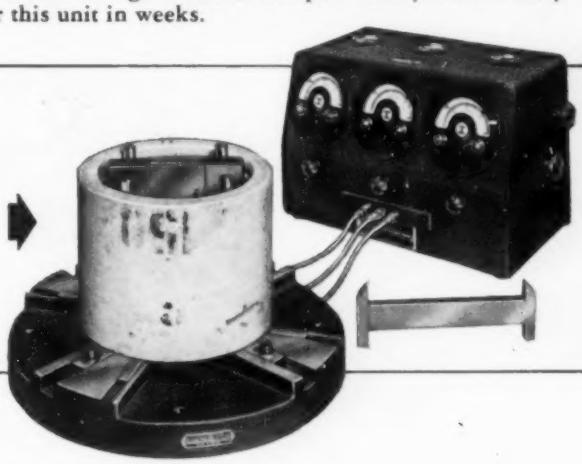


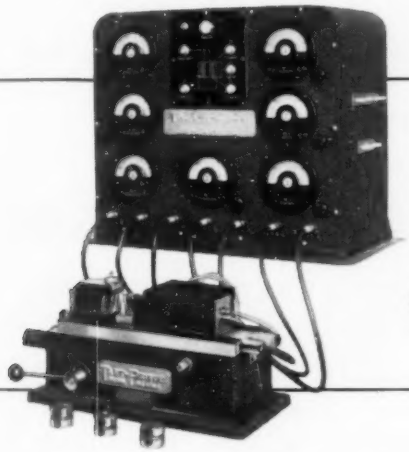
A T-P COMPUTING COMPAIRATOR

For Problems That Involve making two or more measurements . . . then combining them in a time-wasting calculation — such as determining the center distance or concentricity between two holes without respect to hole size. A T-P Computing CompAIRator does the whole job. Measures, computes, and indicates the result instantly on a single dial. Eliminates human error. Savings in time and dependability alone usually pay for this unit in weeks.

FOR CHECKING WIDE TOLERANCES

This T-P Multi-Dial CompAIRator checks several dimensions simultaneously where tolerances are .120". Similar units for tolerances up to .125" can be furnished with any number of indicators and gaging members.





DO IT FASTER, EASIER

T-P Air-Electric Gages simplify multiple gaging problems. Lights flash to indicate oversize or undersize condition, thus saving the operator from checking dials on every measurement.



FOR VERY HIGH PRODUCTION

T-P Automatic Sorting Machines are the ultimate in speed for dimensional inspection. They can be applied to check any reasonable number of dimensions simultaneously. Automatically reject faulty parts, or sort them into size categories.

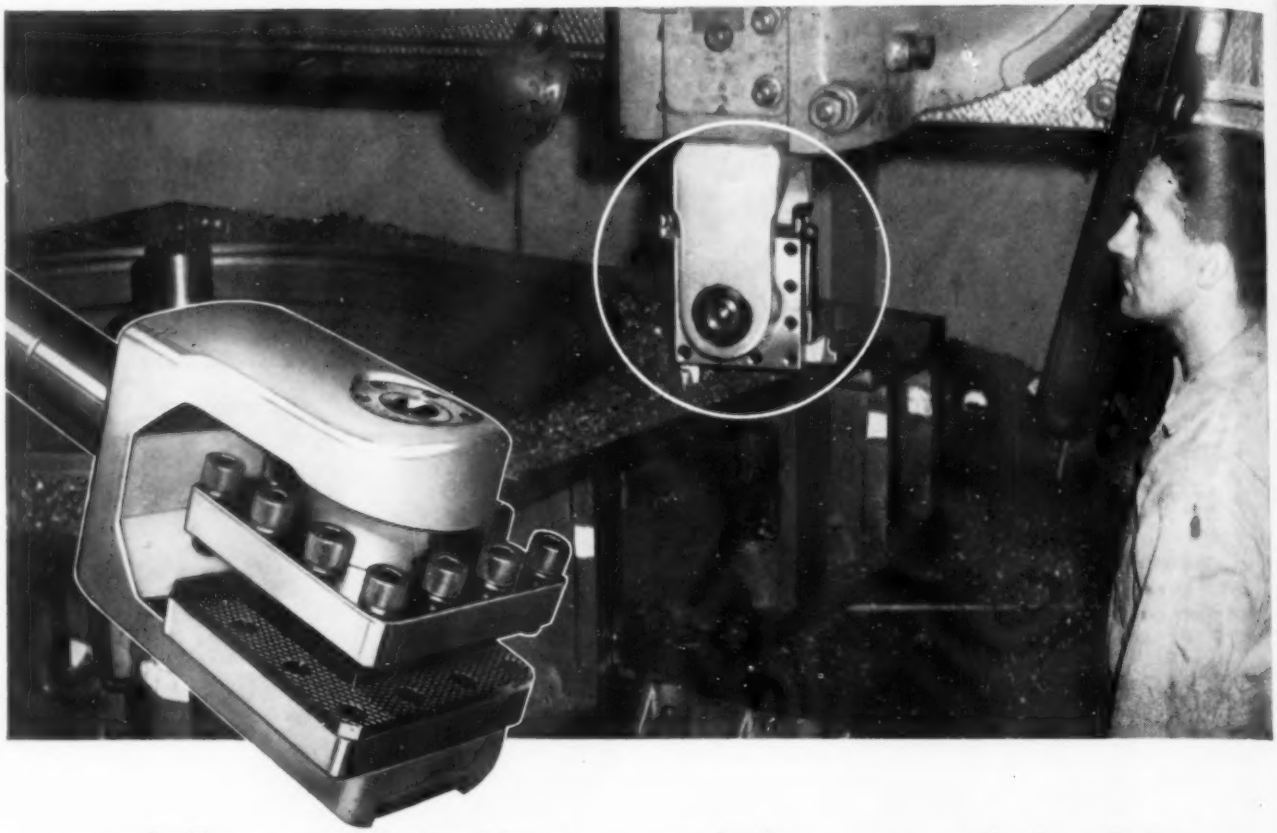
There's a T-P Gage for Every Gaging Problem. For more information on these and many other items, send for your copy of the Taft-Peirce Handbook.

WOONSOCKET, R. I.

T P

T-P means Top Precision

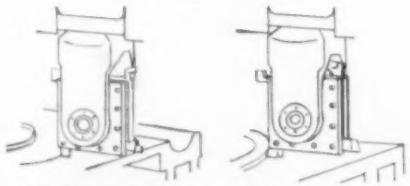
Perform *four* operations from a *single* setup...



—with a DAVIS 8-position tool holder

speeds work, reduces setup costs on vertical boring and turning mills

Typical series of operations on a single setup



8-Position Tool Holder used in facing operation

Tool indexed 90° for undercutting operation

Tool indexed 90° to present turning tool

Tool indexed 45° for chamfering

NOW, save more setup time than ever before possible! With this new Davis Tool Holder you can turn, undercut, bore and chamfer in one setup. You can mount four tools at once.

One simple wrench adjustment will change your position through 360° in accurately indexed increments of 45°. Two index pins and a center pin locate and clamp the complete assembly in rigid alignment. Heavy cast steel body assures accuracy.

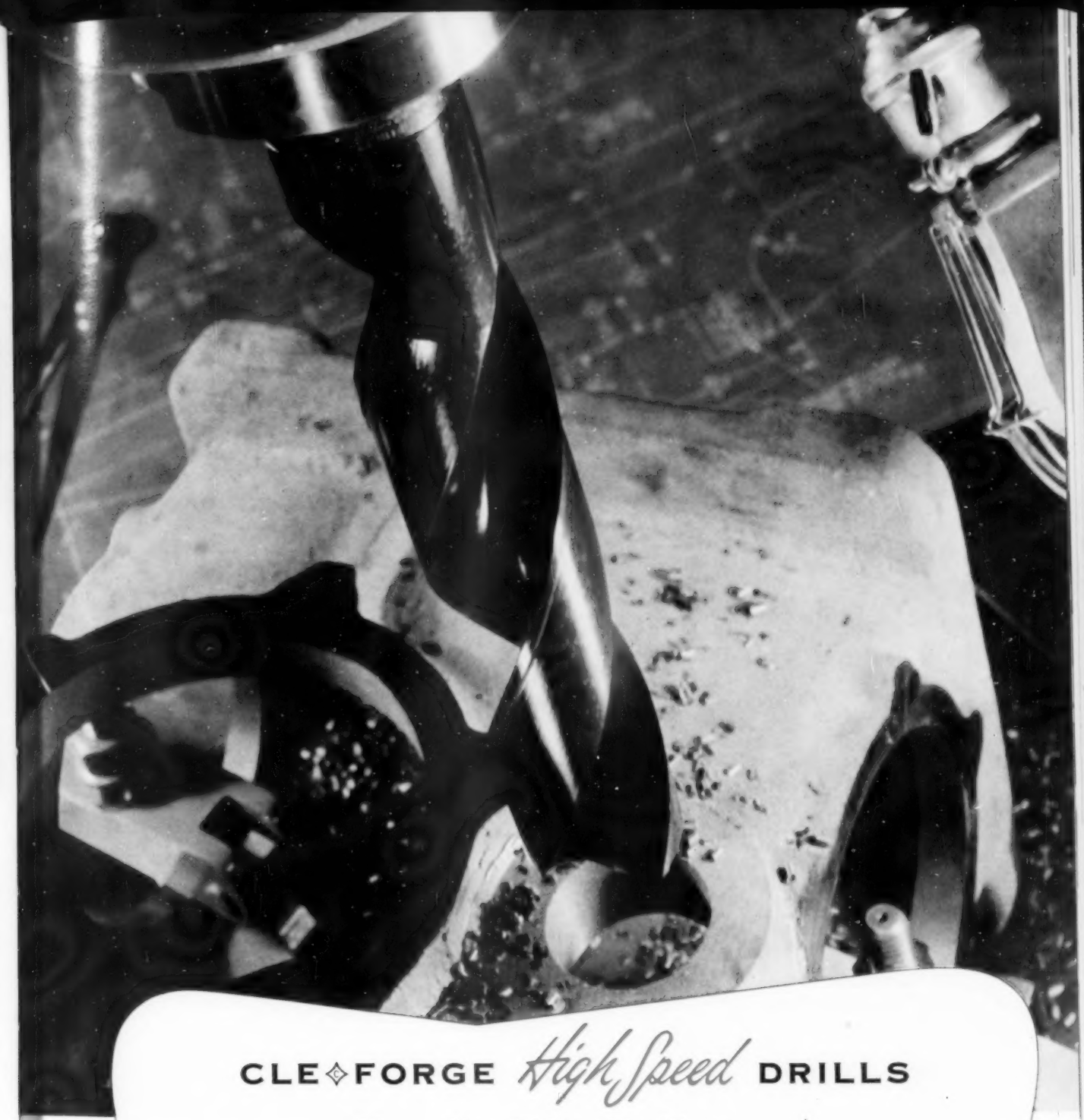
Increase your production with your present equipment . . . solve the age-old problem of too numerous setups, too many tool changes. For details on the Davis 8-Position Tool Holder, see your representative or write direct.

If Davis can't bore it, it can't be done!

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Denison Surge Damping Valve prevents hydraulic shock... eliminates damage to fittings, lines, seals and equipment

Sudden starting, sudden release of high pressure into a low pressure area, or reversal of flow causes a hydraulic surge as damaging to a circuit as blows from a hammer.

The Denison Surge Damping Valve converts the hydraulic surge into a smooth, gradually accelerated flow of fluid power. A hydraulically unbalanced reaction flow control in the valve causes the valve to open slower as the intensity of the surge increases.

Lightweight and easy to install, the Denison Surge Valve can be used on any circuit up to 5000 psi. Requires no adjustment . . . interferes in no way with the efficiency of the circuit.

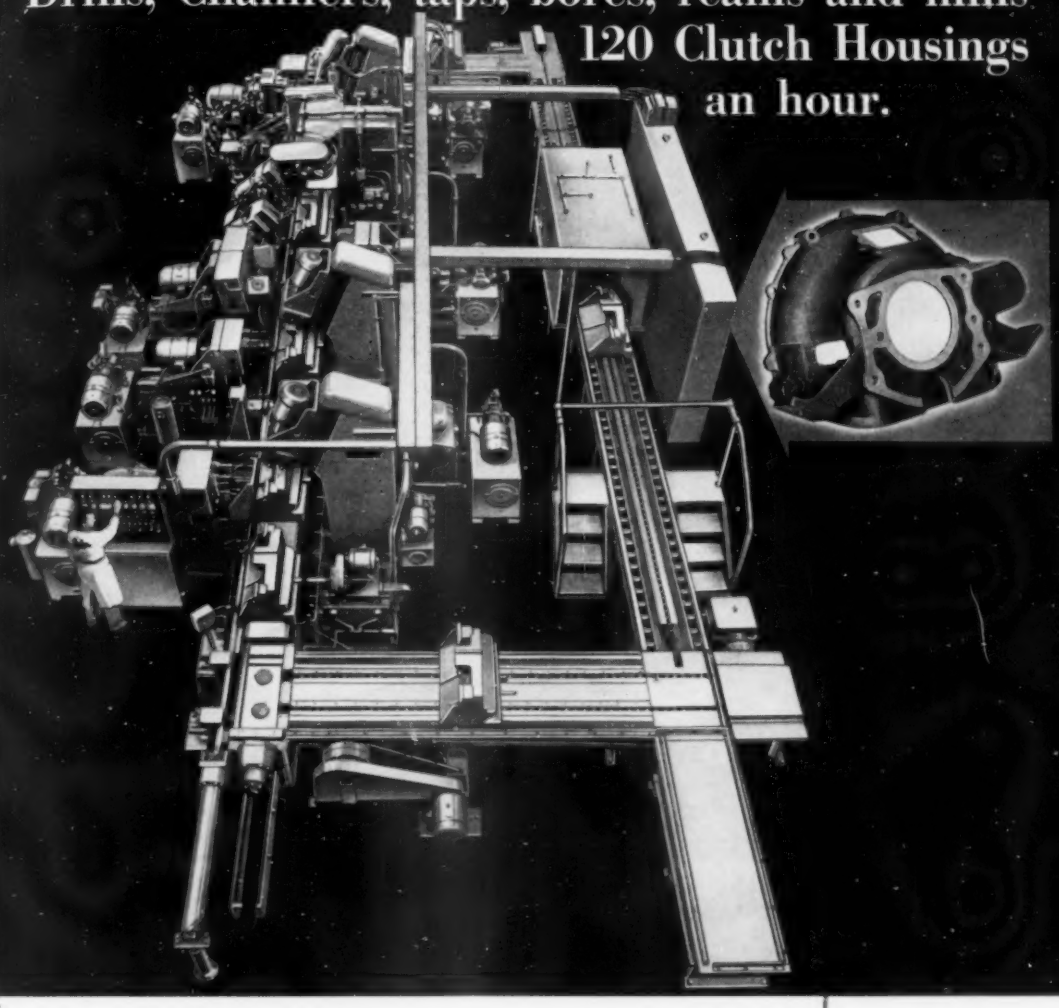
The circuit shows a Denison Surge Damping Valve preventing hydraulic shock when stored-up energy in an accumulator is released. For a bulletin on the surge valve, write to: THE DENISON ENGINEERING COMPANY, 1191 Dublin Road, Columbus 16, Ohio.

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Designed to perform identical operations on two different parts.
Through Selector Switches, change-over from one part to the other takes only seconds.
Twelve stations perform all 68 operations.
Fixtures automatically indexed from station to station, and go through Cleaning Station on return to Load Station, where Power Wrench clamps and unclamps.
Production is 120 parts per hour at 100% efficiency.

BUHR MACHINE TOOL CO.
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TYPICAL STANDARD BUHR FEATURES INCLUDE:

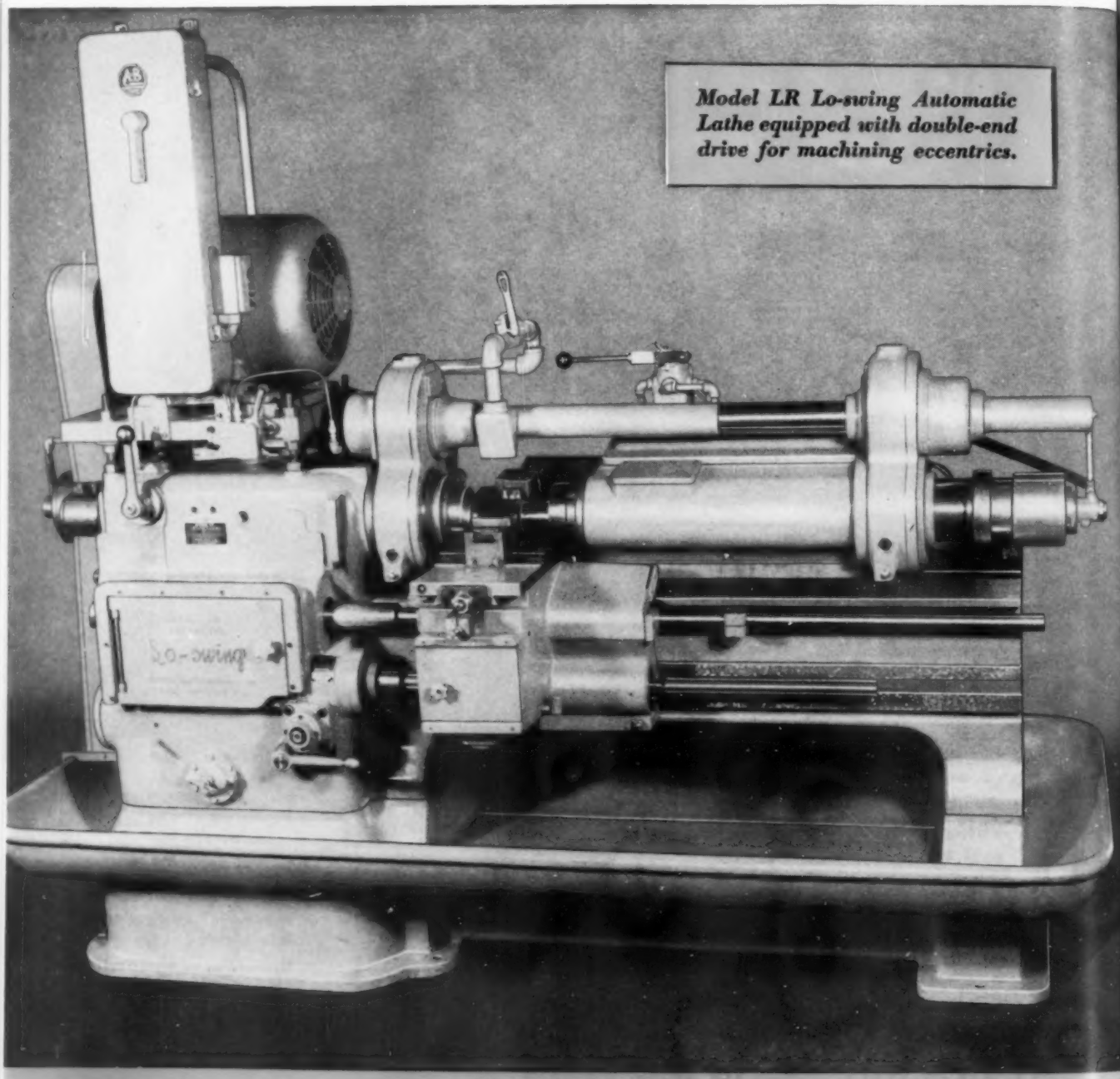
- ★ Built-in chip conveyor.
- ★ Automatic lubrication throughout.
- ★ Hydraulic and electrical equipment to J.I.C. standards.
- ★ Hardened and ground tool-steel ways.

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Buhr MULTIPLE-SPINDLE HIGH PRODUCTION MACHINERY

MACHINE OF

DOUBLE END DRIVE *Lo-swing* LATHE MACHINES ECCENTRICS AT A FAST PACE

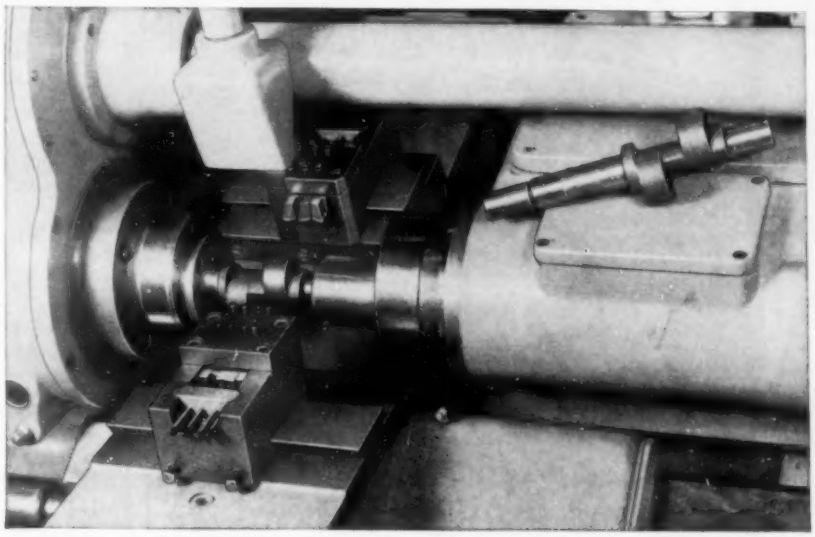


Model LR Lo-swing Automatic Lathe equipped with double-end drive for machining eccentrics.

PRODUCTION COSTS

THE MONTH

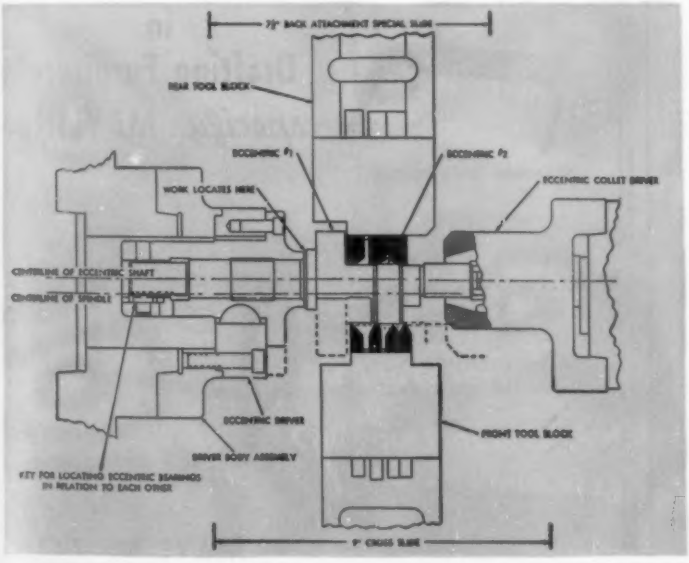
PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



PROBLEM: To accurately machine eccentric bearings on compressor shafts within close tolerances.

SOLUTION: The Model LR Automatic Lo-swing Lathe selected for this operation was equipped with a double-end drive to prevent twisting or distortion of the shaft due to tool cutting pressures. The drive to the tailstock is taken from the headstock spindle and transmitted to the tailstock spindle by means of an overhead drive shaft. Special gearing eliminates all backlash.

The work is held and driven with offset drivers mounted on both the headstock and tailstock spindle noses as shown in the line drawing. The drive from the headstock end is through a key which positions the shaft in relation to either No. 1 or No. 2 eccentrics. The drive from the tailstock spindle is by means of an air-operated collet driver. Loading and unloading of parts is facilitated by an air-operated tailstock which retracts 6-1/2" by a simple movement of an air control valve.



The tooling used for this job is shown on both the line drawing and the close-up view of the operating area of the machine. The front tool block has four tools for turning the eccentric and the clearance diameters adjacent to the eccentric. The back squaring attachment carries three tools, one for facing the side of No. 1 eccentric and the other two for chamfering the edges of No. 2 eccentric.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

ARE LOWER WITH Lo-swing

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✓ ORDER BY DIMENSION OR SYMBOL	LIGHTWAVE CONTROL of Gauging Equipment
✓ FASTER DELIVERY	✓ LARGER AVAILABLE STOCKS IN PRINCIPLE AREAS

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USE READER SERVICE CARD; INDICATE A-8-206-1

TOOL ENGINEERS and TOOL MAKERS

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It's the NEW

MICRO LOCK

QUICK CAMLOCK + MICRO FINE ADJUSTMENT COMBINED

made by the FAMOUS MAUSER

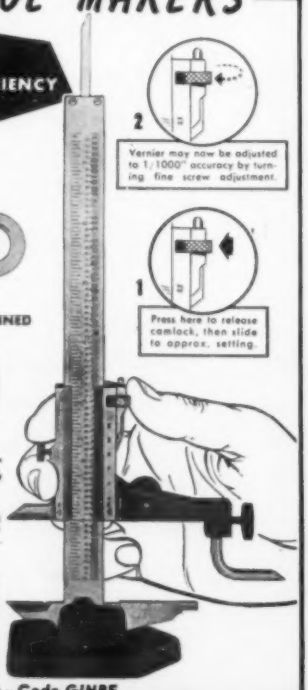
SPECIFICATIONS
Total Length: 9" - Measuring Capacity: 6" - Graduations: 1/1000" & 1/128" - Code Word: GINDO

Without detachable Height Gauge Base and Scriber — $25.50

Same as above but with detachable Base and Scriber - Code GINFU — $33.50

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USE READER SERVICE CARD; INDICATE A-8-206-4

MAYLINE



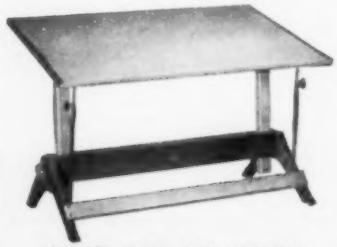
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Red Shield says:

Call your Industrial Supply Distributor for Shield Brand Slitting Saws.
Specialized factory service available everywhere.

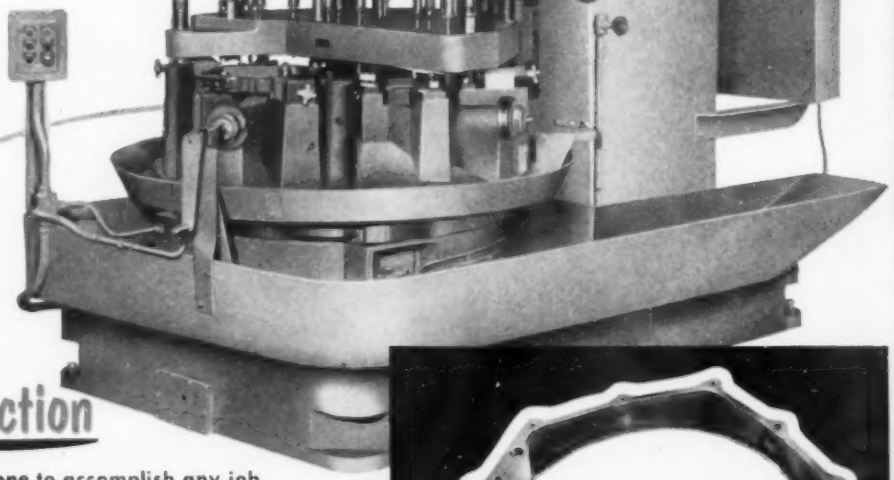
STANDARD TOOL CO.

3950 CHESTER AVENUE CLEVELAND 14, OHIO

FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

MICHIGAN HYDRO 20

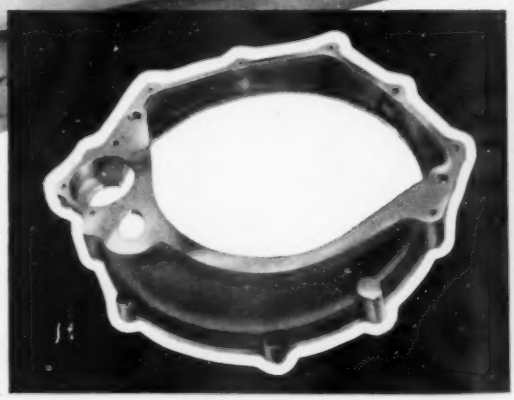


Tooled Up To...

DRILL, REAM
CHAMFER
ROUGH BORE
FINISH BORE
100 FLY WHEEL HOUSINGS PER HOUR

For Faster, More Economical Production

- Rugged column forms firm backbone to accomplish any job
- High strength to power ratio
- Automatically lubricated throughout
- Drill head mist lubricated
- Indicator (mounted at the front) protects motor from overloads
- Fixture mounted on Michigan 4-station 42" hydraulic index table



We also invite your inquiries as to our line of tapping units, and index tables, both manual and automatic

Four other sizes available

Hydro—3 Hydro—10
Hydro—5 Hydro—30

Michigan DRILL HEAD CO. Detroit 34, Michigan

engineers and manufacturers of production machines and drilling equipment



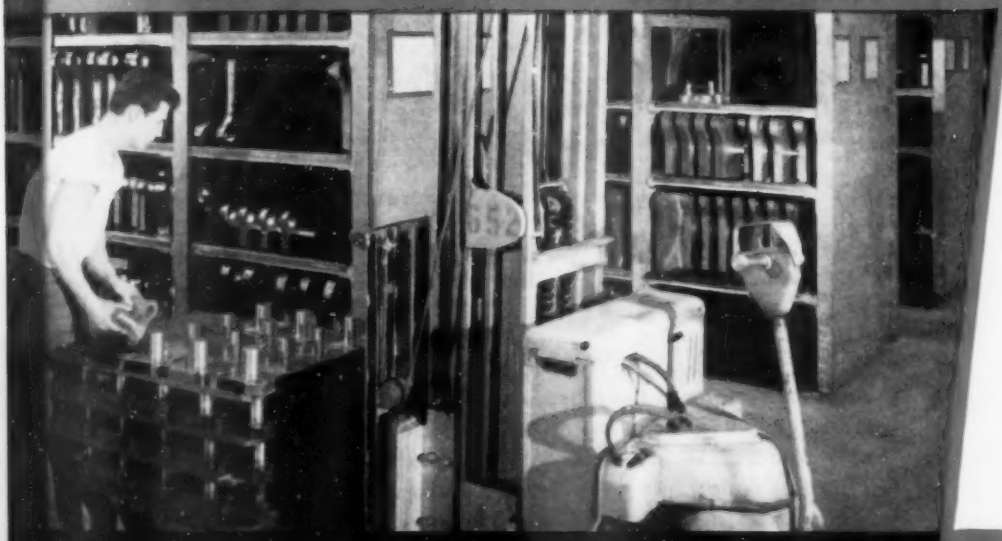
At Danly's Chicago Plant . . . final broaching to assure accurate sizing and parallelism of guide post and bushing holes

World's fastest die set service speeds up your tooling program

Mass production plus local stock means faster delivery

DANLY

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois



At a Danly Branch Plant . . . complete stocks of die set components ready for assembly to your order

*CHICAGO 50
2100 South Laramie Avenue
*CLEVELAND 14
1550 East 33rd Street
*DAYTON 7
3196 Delphos Avenue
*DETROIT 16
1549 Temple Avenue
*GRAND RAPIDS
113 Michigan Street N.W.
INDIANAPOLIS 4
5 West 10th Street
*LONG ISLAND CITY 1
47-28 37th Street

FAST, NATIONWIDE DELIVERY FROM THESE BRANCHES

Danly's new, faster service starts at the main Danly Plant in Chicago where two unique, high-speed, mass production lines are devoted exclusively to the manufacture of interchangeable, precision die set parts. Stocked by Danly Branch Plants in major toolmaking centers, these interchangeable parts are quickly assembled to make up the size and type of die set you need—and delivered to you only a few days after your order is received. Make a note right now of the Danly Branch nearest you from the list given on this page. Next time you need die sets, give your Danly Branch a call. See how they can meet your needs from stock . . . and save you time with fast, local service.

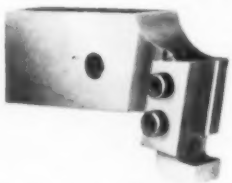
*LOS ANGELES 54
Ducommun Metals & Supply Co.
4890 South Alameda
MILWAUKEE 2
111 East Wisconsin Avenue
*PHILADELPHIA 40
511 W. Courtland Street
*ROCHESTER 6
33 Rutter Street

*Indicates complete stock

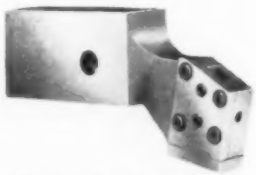
GREENLEE *Automatics*



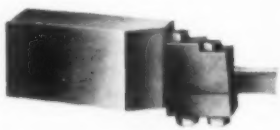
Circular Form-Tool Holder



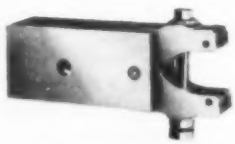
Dovetail Form-Tool Holder



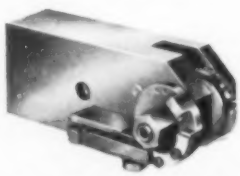
Bit-Type Form-Tool Holder



Cut-Off Tool Holder

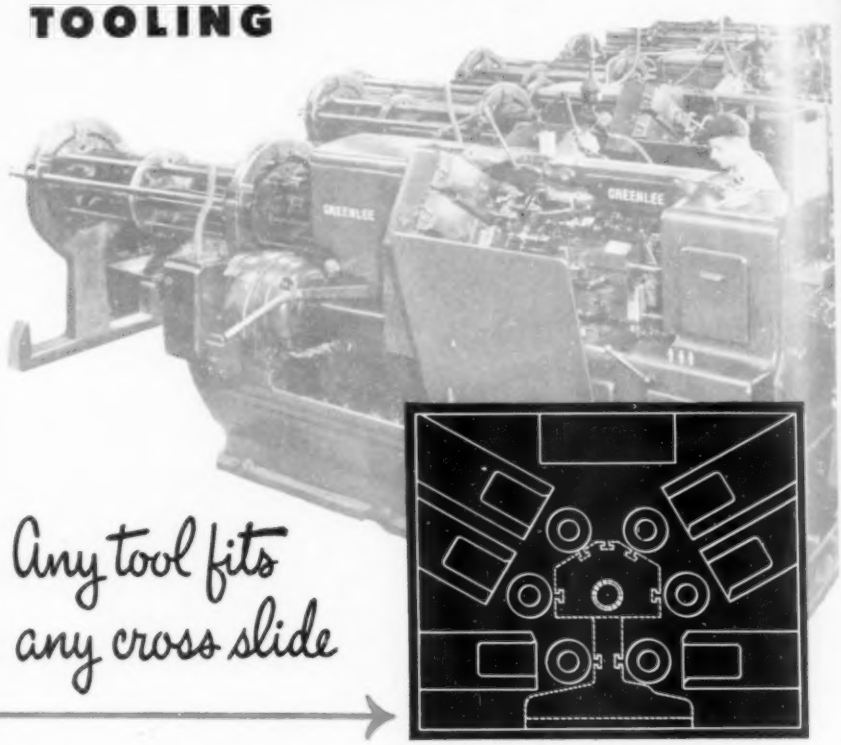


Knurling Tool Holder



Stencilling Wheel Holder

INTERCHANGEABLE TOOLING



Any tool fits any cross slide

SAVE TIME AND MONEY REDUCE JOB COSTS

Among the cost-saving features of Greenlee Automatics, one of the most advantageous is the arrangement whereby *any* of various standardized tool holders will fit in *any* of the six cross-slides. This means not only no limitations as to what tools can be used in which positions, but also a minimum requirement for investment in tools, and a maximum of speed in tool setting when changing over between jobs. *You can profit* from this and the many other outstanding features of Greenlee Automatics.

Write for FREE Literature



Send today for your copy of our 20-page booklet describing and illustrating all the Greenlee features.

PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO.
1988 MASON AVE., ROCKFORD, ILL.

Automation with Miller CYLINDERS



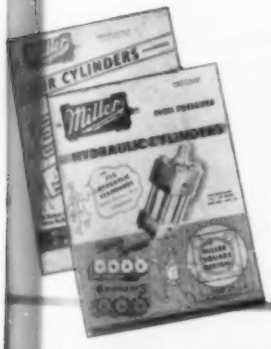
...assures non-stop production flow with BIG savings in maintenance and investment cost!

The production magic of "AUTOMATION" demands faultless performance—as the failure of one important component of "automation" machinery and equipment can shut down an entire manufacturing process.

In the "automation" application illustrated above, 22 Standard Miller High Pressure Hydraulic Cylinders are employed on each of two identical automotive transfer machines built by Ex-Cell-O Corp. of Detroit, Michigan, a recognized leader in the design and manufacture of "automation" equipment.

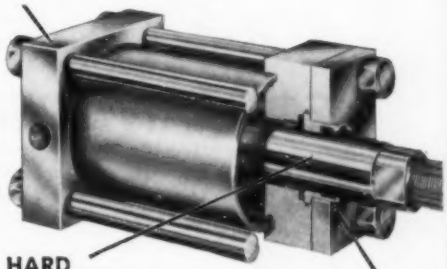
The machines perform—simultaneously and automatically—drilling, countersinking, counterboring, and tapping operations on automotive cylinder heads. And the Miller Cylinders accomplish the vital clamping, feeding, holding, rotating and locating operations that enable the machines to function as smooth "automation" production units.

Miller Cylinders are ideal for such "automation" applications. They withstand severest shock loads, provide millions of smooth strokes without repacking of seals or other maintenance. Their space-saving square design cuts installation and designing costs. They're available in an infinite variety of versatile power and stroke units that cover every need and permit the most economical choice for the application. And they fully meet the J.I.C. Standards.



Consult our engineering department or local representative. And write for complete information on this and other interesting applications and for our FREE Cylinder Bulletins A-105 and H-104.

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage



HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

DIRT WIPER SEALS
Protect Rods, Seals, Bushings

SALES AND SERVICE FROM COAST TO COAST

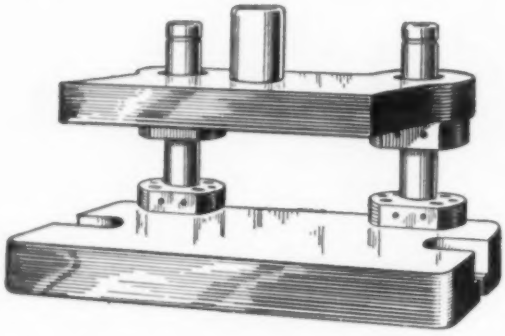
CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

MILLER FLUID POWER CO.
(Formerly MILLER MOTOR COMPANY)

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

BAUMBACH DIE SETS GET THERE FASTER!



— SEE YOUR PHONE BOOK FOR LOCAL DISTRIBUTOR —

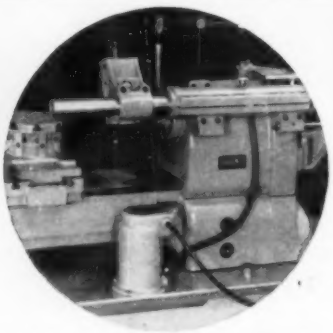
E. A. BAUMBACH MFG. CO.

1812 SOUTH KILBOURN AVENUE

CRawford 7-4041 CHICAGO 23, ILLINOIS

USE READER SERVICE CARD; INDICATE A-8-212-1

RUTHMAN GUSHER COOLANT PUMPS



This Hardinge Model HCT Chucking Machine with Production Threading Head is equipped with a Gusher Coolant Pump.

SOLVE YOUR COOLANT PROBLEMS



For all your coolant pump requirements, there's a type and capacity Gusher Coolant Pump to meet your every need.

You can choose between immersed type, outside mounted pipe connected, flange mounted with external or internal discharge in capacities up to 200 G.P.M.—1/30 to 2 H.P. Shaft and belt driven models also available. Write for our complete catalog.

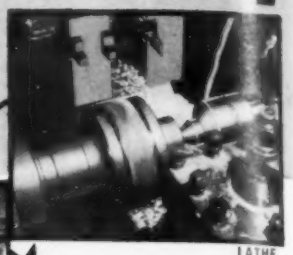
THE RUTHMAN MACHINERY CO.

1810 READING ROAD CINCINNATI, OHIO

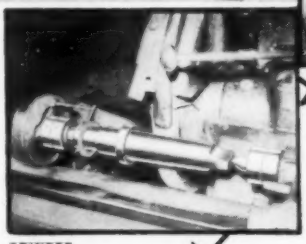
USE READER SERVICE CARD; INDICATE A-8-212-2



If Your Problem CENTERS here TURN TO RED-E



LATHE



GRINDER

AND BE SURE!

Red-E Precision CENTERS are the answer to all your turning and grinding ACCURACY problems.

Built to take weights up to 200 tons. Speeds to 4000 RPM.

Your ONE Source

for ALL Centers — over 200 models — Standards and Specials for Lathes, Grinding, Milling, Spinning, Turret, Screw Machining, Burnishing and Gear Cutting operations.

ACCURACY is GUARANTEED

Buy from your RED-E Distributor

CENTER *Specialists Since* 1908

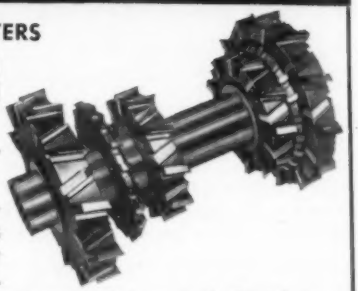
RED-E-TOOLS READY TOOL COMPANY

558 Iranistan Ave. • Bridgeport, Conn.

USE READER SERVICE CARD; INDICATE A-8-212-3

APEX TOOLS

APEX MILLING CUTTERS



Made with inserted Blades, all drop-forged of selected steels.

Adjustable for diameter or width.

Single or multiple operations with blades of High Speed, Super Cobalt, Stellite, Rexalloy, or Carbide Tipped. Standard sizes, including large diameters, carried in stock.

APEX TOOLS FOR LIGHT OR HEAVY PLANER WORK

Adjustable serrated for maximum wear. Over 50 standard shapes of tool bits interchange in one holder. Angle tools for Plate Planers carried in stock. Special shapes to order.

Tools drop-forged of High Speed Steel, Super Cobalt Steel, or tipped tools of Stellite, Rexalloy, or any grade or make of Carbide. Furnished ground ready for use.



Service representatives available.

Send for catalog.

APEX TOOL & CUTTER CO., INC., Shelton 16, Conn.

USE READER SERVICE CARD; INDICATE A-8-212-4

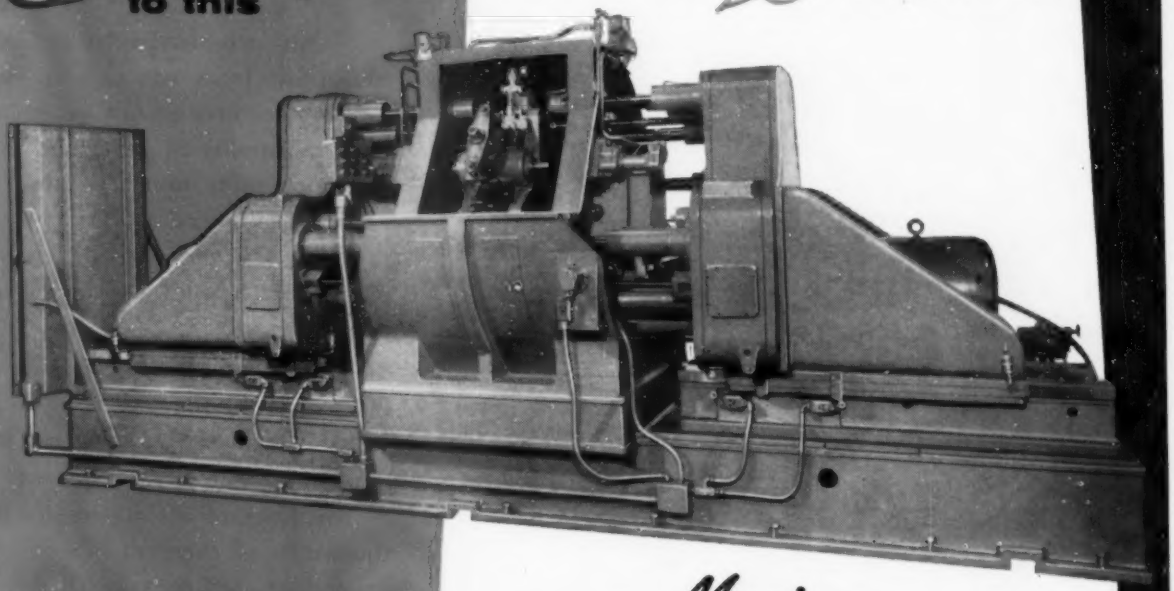


from this...



to this

...in just 23 seconds!



with this *Morris* mor-speed production machine

STATION	OPERATIONAL CYCLE:
1	Double Load and Unload
2	Drill four 1" holes
3	Re-drill holes to 1 7/16"
4	Rough face four holes
5	Finish face four holes
6	Chamfer four holes

The Morris Two Way Horizontal High Production Machine finishes universal joint flange yokes at the rate of 156 per hour at 100% efficiency.

It, like other Morris MOR-SPEED Machines, is made up of standard MOR-SPEED units plus certain special parts. Because of Morris methods and standard designs, the user gets a special purpose machine . . . capable of high speed, precision production . . . without the usual sky-high cost and limited application of a "special machine."

Morris MOR-SPEED Machines save space, time and costs for leading manufacturers in every industry.

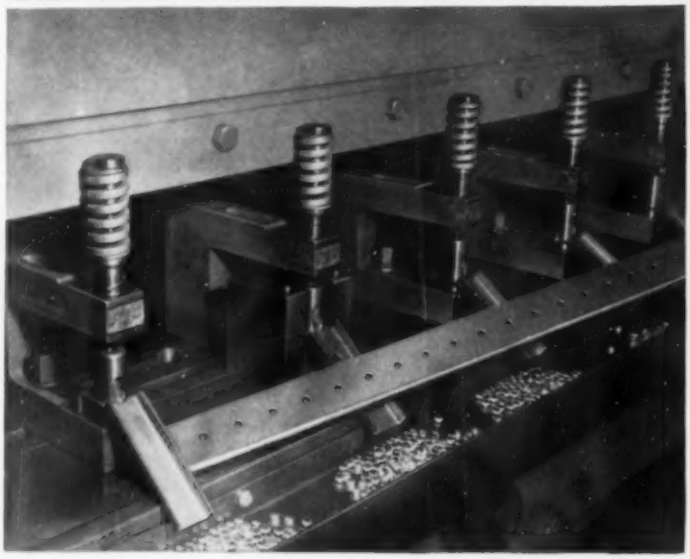
If you have multiple drilling, tapping, boring or similar operations on a mass production basis, Morris Engineers may may be able to show you substantial savings on a modest investment.

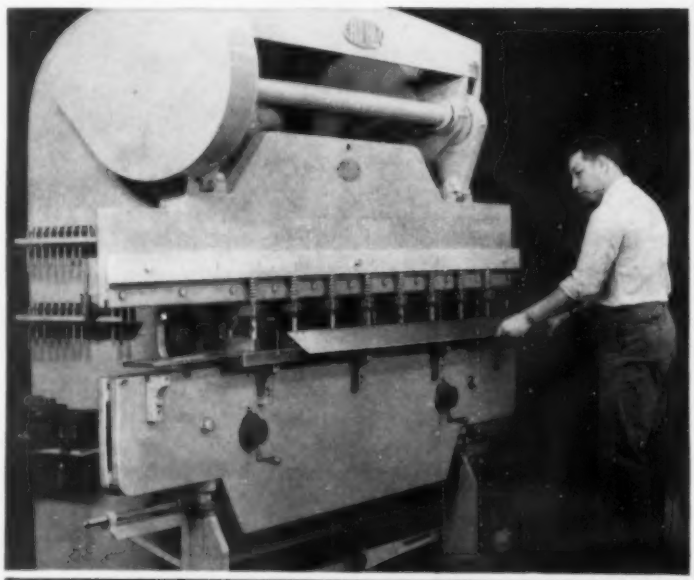
Morris

THE MORRIS MACHINE TOOL CO.
950 HARRIET STREET
CINCINNATI 3, OHIO

What another user says about

WALES HOLE PUNCHING AND NOTCHING EQUIPMENT





Mr. H. J. LOCKWOOD, Plant Superintendent, BULLDOG ELECTRIC PRODUCTS OF LOS ANGELES, *writes:*

"Our products must maintain perfect uniformity from run to run, as one of the primary features of our switchboards is interchangeability of parts and the ability to add new units to an existing installation as our customers' manufacturing facilities expand. The use of Wales-Strippit equipment and templates assures this degree of perfection.

"When we recently embarked on a program of manufacturing power switchboards, my production methods were naturally centered around Wales equipment."

Mr. Lockwood's experience is typical of thousands of users of Wales patented, independent, self-contained Hole Punching and Notching Units that are used and reused in unlimited setups in press brakes and stamping presses.

Wales time-saving, cost-saving methods make it a BIG story. Write for fully illustrated, functionally colored Catalog CJ TODAY.

TOP: Close-up of Wales Type "CJ" Hole Punching Units with pin stop gaging for punching 56 holes (17/64" diameter in 5/16" thick copper) on 1¼" centers in bus risers and matching holes in steel mounting frames.

BOTTOM: Wales Type "CJ" Hole Punching Units set up at BULLDOG Electric Products of Los Angeles. Note use of ram bar on front of ram to increase operating shut height of press brake.

WALES-STRIPPIT CORPORATION

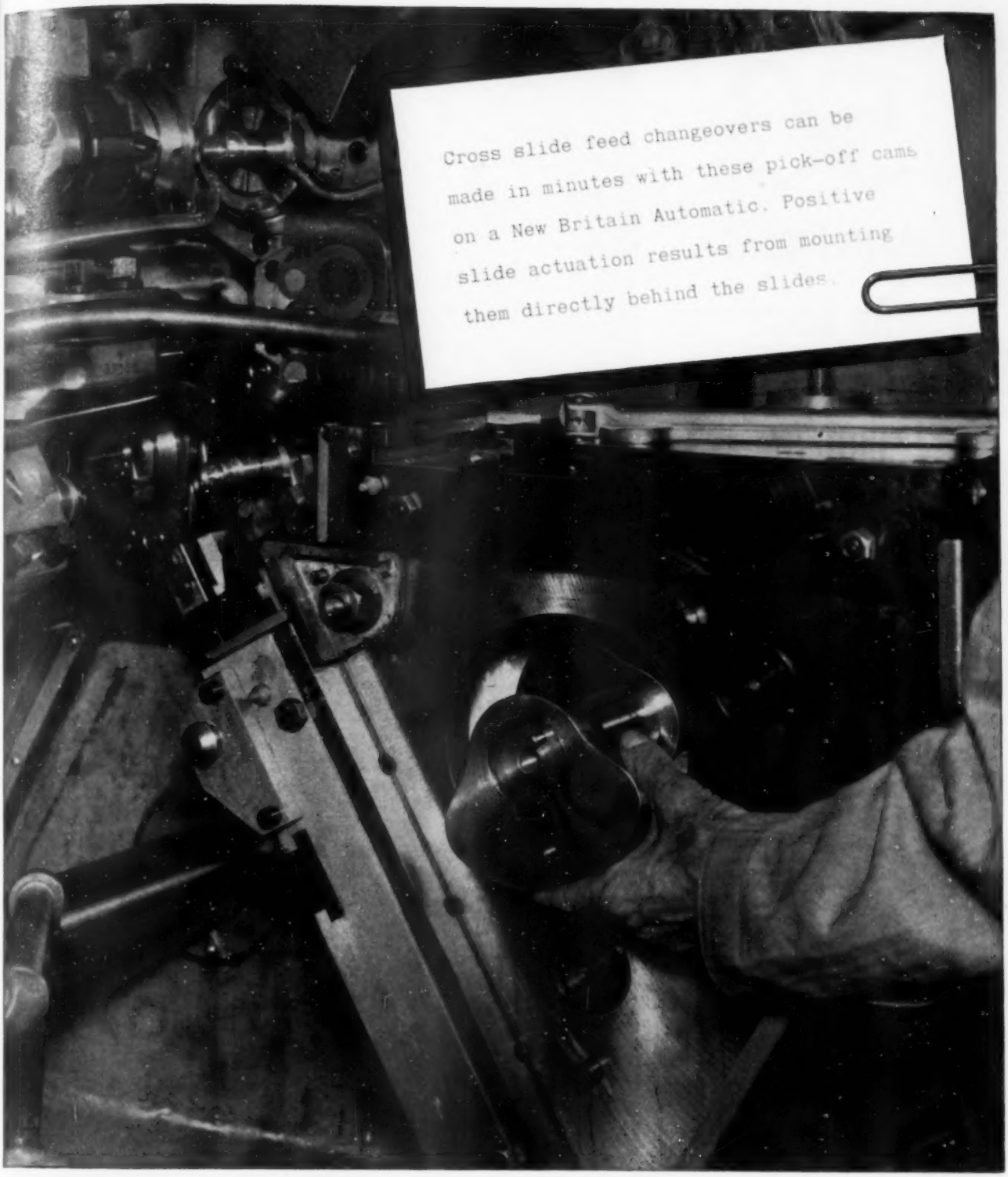
George F. Wales, Chairman

393 Payne Avenue, North Tonawanda, N. Y.

(Between Buffalo and Niagara Falls)

Wales-Strippit of Canada Ltd., Hamilton, Ontario

Specialists in Punching and Notching Equipment



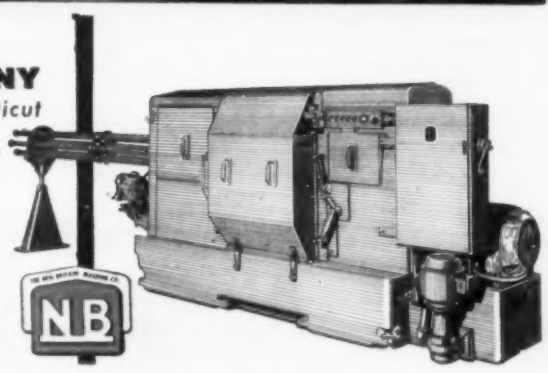
THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut

NEW BRITAIN *Automatics*

Machines for Making Progress

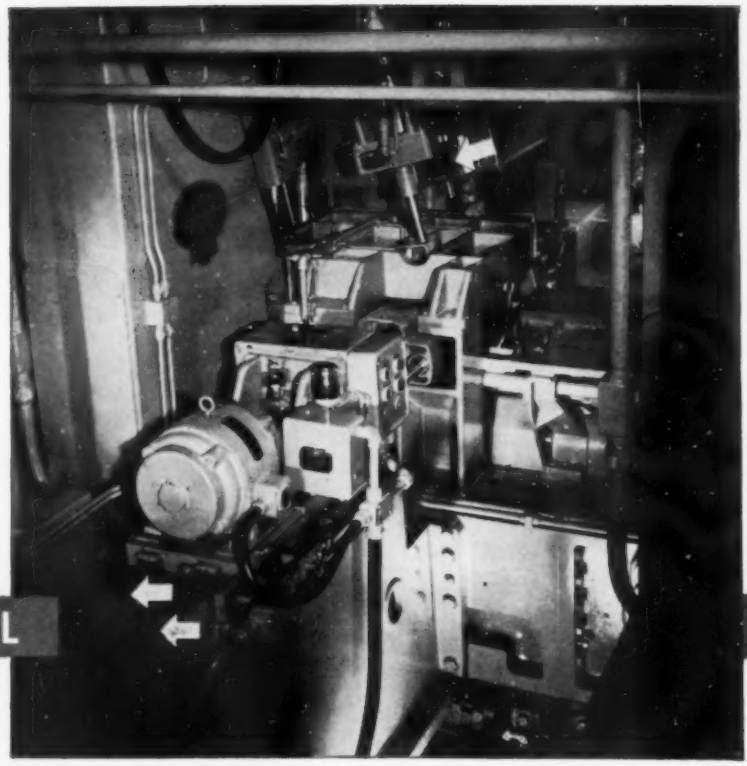
Automatic Bar and Chucking Machines
Precision Boring Machines
Lucas Horizontal Boring, Drilling and Milling Machines
New Britain +GF+ Copying Lathes

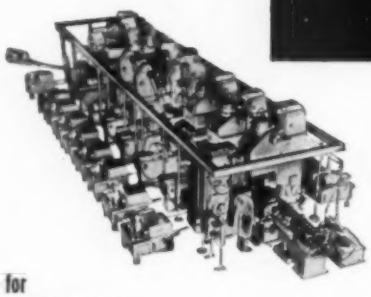


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-215

50 Auto Blocks An Hour!

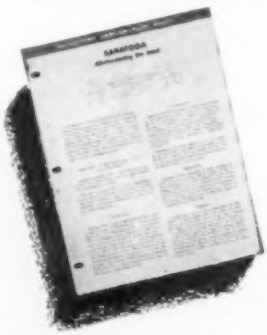
WITH THE HELP OF LUDLUM SARATOGA TOOL STEEL





Ludlum Saratoga was used for the steel ways (note arrows, above) of this giant unit, illustrated at left in a bird's-eye view reduced to miniature size.

Write for BLUE SHEET ON SARATOGA



This concise four-page folder gives all needed handling and shop treatment details on Saratoga. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

Address Dept. TE-56

98 SEPARATE OPERATIONS are carried on by this versatile machine which turns out 50 V8 auto engine blocks an hour. It consists of 18 machining units, each of which is fitted with hardened and ground steel ways of Ludlum Saratoga to guarantee accuracy in production.

MILLING, TREPANNING, DRILLING, counterboring, reaming, chamfering, automatic inspection of holes for depth and removal of chips are the operations performed by this amazing mechanism.

LUDLUM SARATOGA WAS USED BECAUSE its extreme hardness, high resistance to wear, and excellent machinability more than met the customer's high requirements for maintaining accuracy in this huge, multi-station machine.

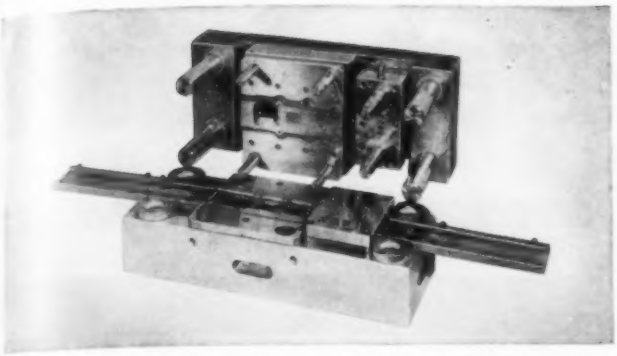
ALLEGHENY LUDLUM METALLURGICAL SERVICE can solve *your* tool or die steel problems. ● Call your local A-L representative or distributor today, or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pennsylvania.*

For complete **MODERN** Tooling, call

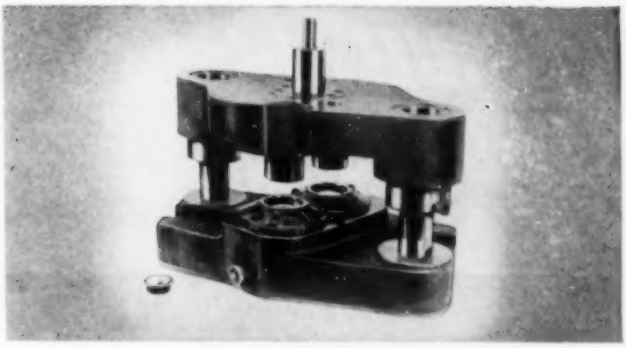
Allegheny Ludlum

WAD 5155

AL® FINE TOOL STEELS SINCE 1854



1 Lamination die, made for Schick, Inc., produces rotor and stator laminations of motor-grade silicon steel. Customer reports carbide die produces average runs 35 times as long as steel dies.



2 Blanking and drawing of screw bottle caps is done by this die for Armstrong Cork Company, Lancaster, Pa. Die operated accurately on material .006" thick for months. Steel die had to be changed each week.

Case histories show how dies reduce costs when equipped with Carboloy® cemented carbide



3 Simple pierce and cutoff die, designed for Electric Auto-Lite Co., Toledo, operates at speeds faster than 400 strokes per minute. Die has produced over 2,000,000 strokes . . . and still does not require sharpening.

Actual plant performance has proved how easy and profitable it is to use Carboloy cemented carbide over a wide range of applications. For blanking, forming, drawing and piercing . . . for large or small, simple or complex dies . . . only carbides will give you benefits like these:

- **Production runs 35 times greater than steel (see picture No. 1)**
- **Accurate tolerances held for months . . . as compared to days with steel (see picture No. 2)**
- **Over two million high-speed strokes . . . without needing resharpening (see picture No. 3)**

If you wish, a member of the Carboloy Engineering Appraisal Service will call at your plant, without obligation. He'll show you how simple it is to wear-proof your dies; how to get increased production with fewer rejects. And you can send your key personnel to the Carboloy Die School in Detroit.

Also free is the Carboloy Die Engineering Manual D-124. It shows you how easy it is to design, apply and maintain carbide dies. For any of these free, cost-reducing Carboloy services or literature, send coupon below.

FILL OUT THIS COUPON—MAIL IT TODAY!

CARBOLOY Department of General Electric Company
11101 E. 8 Mile Street, Detroit 32, Michigan

- ☐ Rush me free Carboloy Die Engineering Manual D-124.
- ☐ Send complete details on free Carboloy Die Training School.
- ☐ Have a representative of the Carboloy Engineering Appraisal Service call at my plant, at no obligation to me.

Name_____ Title_____

Company_____

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CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

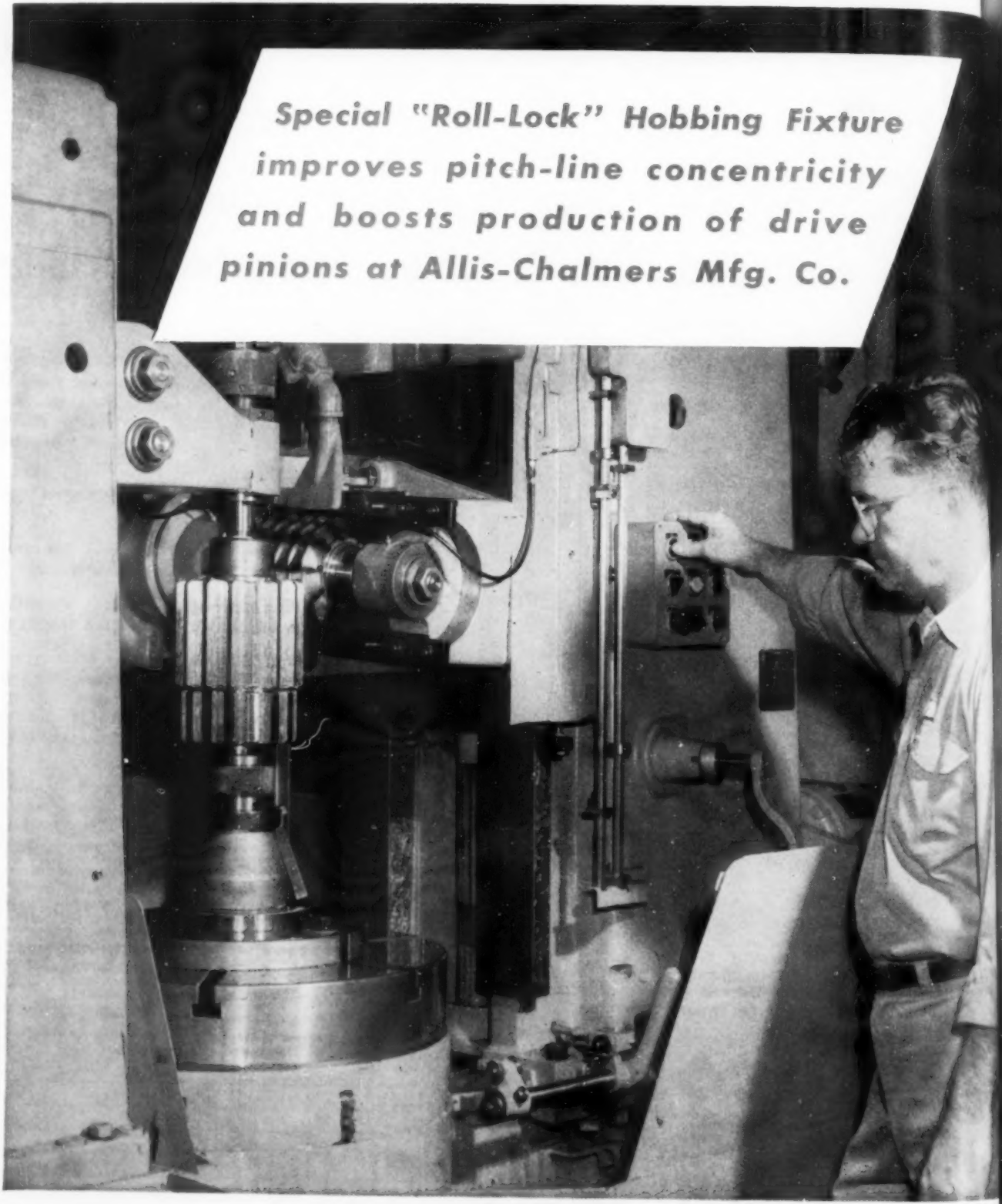
"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

SCULLY JONES

"Precisio

make hobbing...an

Special "Roll-Lock" Hobbing Fixture improves pitch-line concentricity and boosts production of drive pinions at Allis-Chalmers Mfg. Co.



Holding" Tools

other machining jobs more profitable

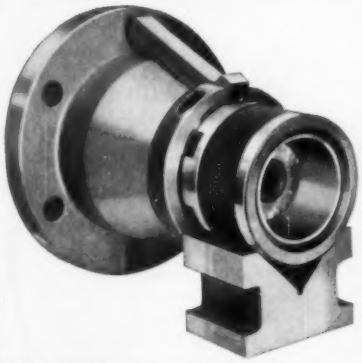
Provides accurate, centering, shrink fit on ground hub of pinion.

It's a new way of holding and driving the work for hobbing . . . as accurate as holding between centers . . . faster and *more accurate* than conventional chucking.

This Scully-Jones special "Roll-Lock" Chucking Fixture easily increased production of tractor drive pinions 10% by reducing handling time and increasing rigidity to permit heavier feeds. Other benefits reported are:

Pitch-line concentricity and accuracy of involute were improved because the solid compression shell applies *equal force* evenly around the ground hub of the pinion, accurately centering it . . . and eliminates all clearance or play. Hob life was increased, too, and finish was improved because vibration is eliminated.

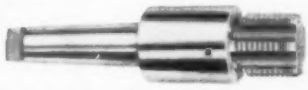
Use of Scully-Jones standard or special "Roll-Lock" Chucks, Arbors and Mandrels *on a variety* of your machining operations will be just as profitable. Read about wide range of application in Bulletin No. 17-50.



Special "Roll-Lock" Chuck is bolted to work spindle of Gould & Eberhardt gear hobber. Spacers adapt it to various hub lengths. Split collets are used to accommodate different diameters.

THE SCULLY-JONES TOOL BUYER'S GUIDE

Heavy-Duty Tap Holders—Hold and drive large taps in machines having a Morse taper hole. Special alloy steel, hardened by toughening process, resists nicking and burring . . . keeps taps running true. Shank and hole concentric within .002". Standard sizes for hand and pipe taps, from ¾" to 3". Bulletin No. 4-50.



Center Drill Drivers—Accurately drive combined center drills and countersinks (regular and bell types) because bore and shank are precision finished. Flutes drive off spline section of bore. Countersunk hole protects drill tip. Morse taper shanks, 15 sizes for ⅛" x 3/64" to ¾" x 5/16" drills. Bulletin No. 1-50.



Close-Center Tap Drivers—Give maximum clearance between centers or near shoulder. Permit use of hand taps in place of pulley taps and special length taps. New improved design assures long life. Short, medium and long series. Bulletin No. 4-50.



Drill Stops—Use them on turret lathes, radial drills and other machines to control depth of hole. Save time on sequence operations using quick-change setup. Eight standard sizes, with Morse taper shanks and hole dia. from ¼" to 1½". Bulletin No. 18-50.



Quick-Change Chucks—Change tools fast on sequence drilling, reaming and tapping jobs without stopping machine. Merely lift locking ring, and collet with cutting tool drops out. After inserting new collet, release ring and tool is ready to cut. Collets for Morse taper shanks. Bulletin No. 3-50.



Sleeves, Sockets, and Turret Tool Holders—Hardened-and-ground precision sleeves reduce any ASA or Morse taper hole to smaller taper. Short, medium and long series extension sockets handle most jobs. Short, sleeve, and extension type turret tool holders in wide range of sizes. Bulletin No. 7-50.



Milling Arbors—Styles "A" and "B" provide rigid, accurate drive on machines having National Standard spindle end. Arbor and pilot dia. held to +.0000", —.0005". Faces of spacers and bearings parallel within .0002". Keep cutters true. Standard sizes with 40 and 50 NMTB tapers. Bulletin No. 2-50.



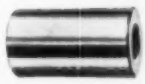
Milling Machine Adapters—Shell end mill arbors available in range of sizes and styles. Collet holders, cutter chuck adapters, centering plugs and other adapters stocked for fast service. Bulletin No. 2-50.



Solid Spacing Collars—Do not "spring" arbors because faces lapped parallel within .0002". Keep cutters running true. Standard sizes, from .006" to 6" thick, ⅜" to 2½" bore. Bulletin No. 2-50.



Arbor Bearing Sleeves—For standard styles "A" and "B" arbors. Bore and O.D. concentric within .0005"; faces parallel within .0002". Standard sizes from ⅞" to 2½" bore dia. Bulletin No. 2-50.



Live Centers—Use them for high speed turning without losing accuracy. Extra large bearing surfaces absorb shock loads easily. Runout within .0002" T.I.R. Capacities—1000 to 2400 lbs. Bulletin No. 9-50.



Work Rest Blades—Save many ways. TC tipped segment type blades for through feed, infeed and roller infeed grinding. Range of sizes. Bulletin No. 11-50.



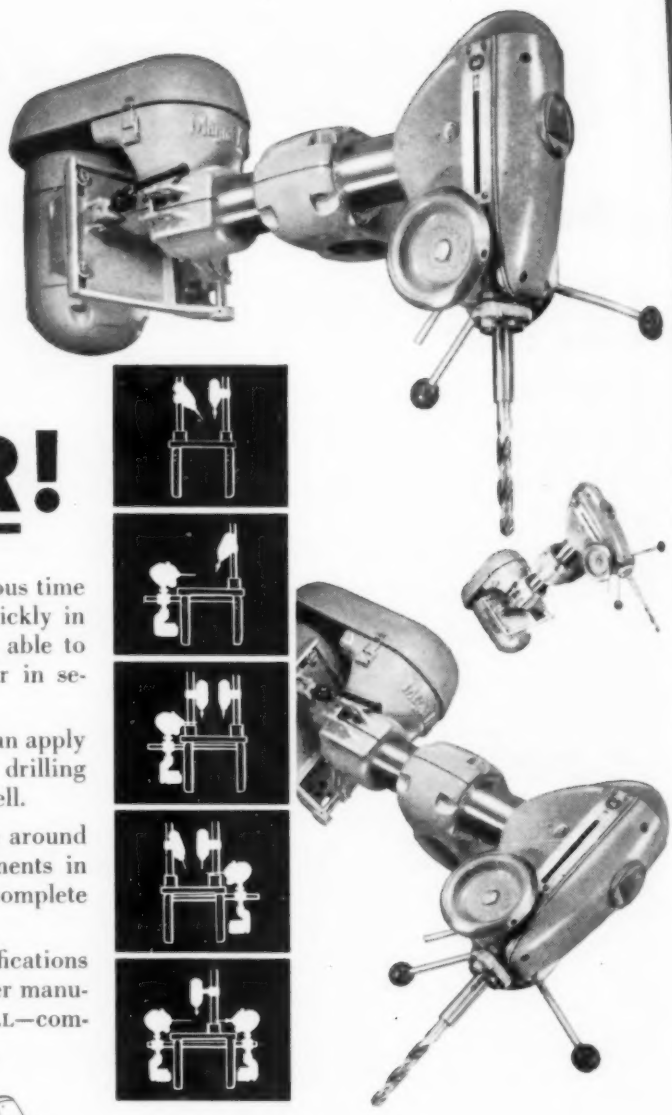
STOCKED BY SCULLY-JONES DISTRIBUTORS IN ALL PRINCIPAL CITIES

SCULLY-JONES

"Precision Holding" for holding precision

SCULLY-JONES AND COMPANY, 1915 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

Just imagine drill heads you could anchor in AIR!



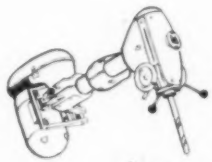
Think of the production possibilities . . . the tremendous time and cost savings . . . being able to locate spindles quickly in mid-air, at any angle, in any combination . . . being able to drill or tap any number of holes, simultaneously or in sequence, automatically or manually.

A startling concept? Using MAGNA DRILL, you can apply it right now in your own plant. Not only for special drilling and tapping jobs, but for standard operations as well.

For with MAGNA DRILL, you build the machine around the part—just as if you were anchoring the components in air instead of to the rigid steel columns that provide complete freedom of setup.

Interested? Then let us send you details, specifications and prices. Also application sheets showing how other manufacturers are making profitable use of MAGNA DRILL—complete with cost breakdowns. Simply mail the coupon.

1001 QUICK SETUPS POSSIBLE WITH MAGNA DRILL MODULAR COMPONENTS



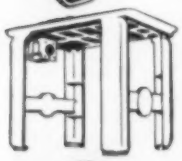
DRILL HEADS. Individually powered. Fully adjustable. Right or left hand manual feed. Choice of spindles. Price complete, less motor, $285*.



POWER FEED (Mechanical Type). Quickly attached. Feed rates .003" to .012" per revolution. Solenoid engage. Spring return. Automatic cycling. $195*.



COLUMNS AND BASES. Heavy ⅜" walled tubes. 3½" O.D. Precision ground. Angle indexed. Bases are line-bored cast iron. $48*.



TABLES AND LEGS. Drilled and tapped for mounting bases horizontally or vertically. Tables may be ganged. Single table, 24"x 20," $185*. Double, 24" x 40," $285*.

LEAD SCREW TAPPER. Replaces standard quill in 10 minutes. Includes reversing starter and controls, limit switch control plate, all wiring. $260*.

*F.O.B. your plant.



MAGNA ENGINEERING CORPORATION, *Dept. 268-K, at factory nearest you*
12819 Colt Road, Cleveland 8, Ohio, OR Menlo Park, California

☐ I'm interested. Send me specifications, prices and application sheets for MAGNA DRILL.

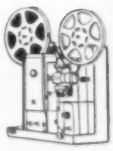
☐ Would like to arrange a showing of the MAGNA DRILL film on or about _____ (date).

Name _____

Position _____

Company _____

Address _____



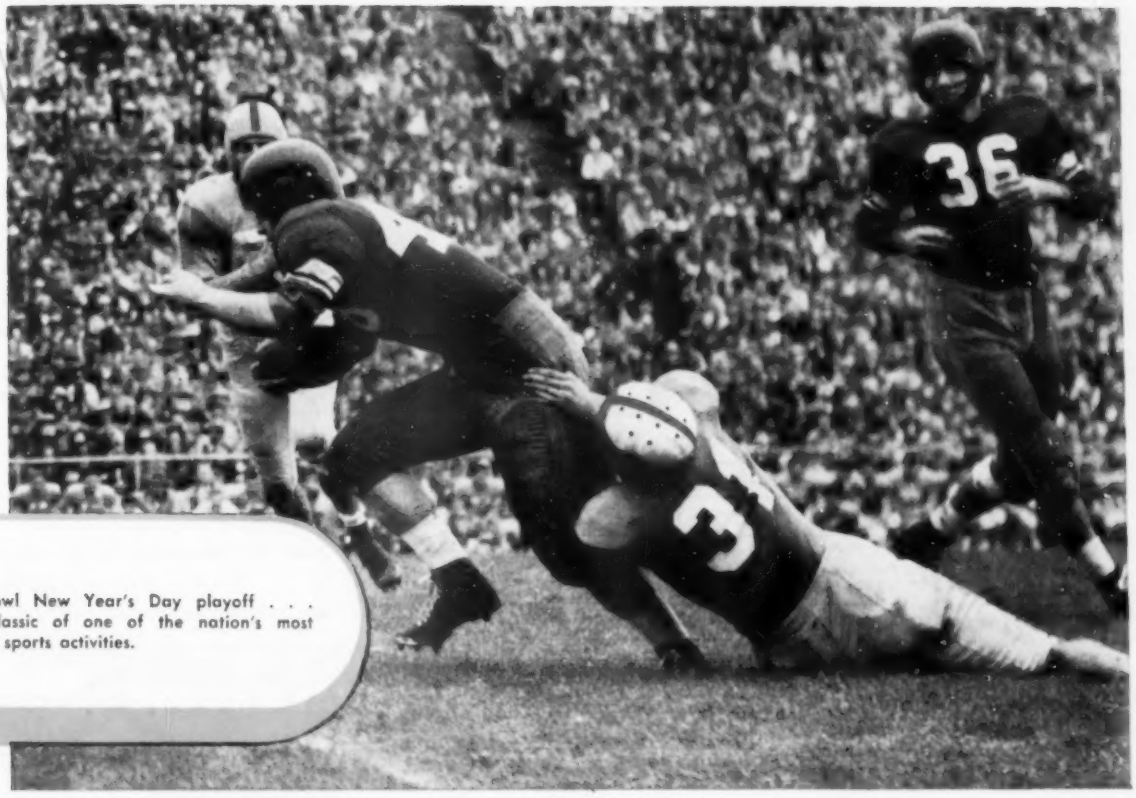
SEE MAGNA DRILL IN ACTION ON FILM!

Now you can see the full, dramatic, cost-cutting possibilities of MAGNA DRILL right in your own plant. A 20-minute, 16mm sound film is available for showing to interested groups wherever they may be located. Just address your request to Magna Engineering Corporation, Menlo Park, California. We'll make all the arrangements. This is one movie you won't want to miss!

"MAGNA DRILL" FILM IS LISTED BY THE NATIONAL HEADQUARTERS OF A.S.T.E. (Speakers Directory under "Drilling"). PLAN TO SHOW IT AT YOUR NEXT MEETING.

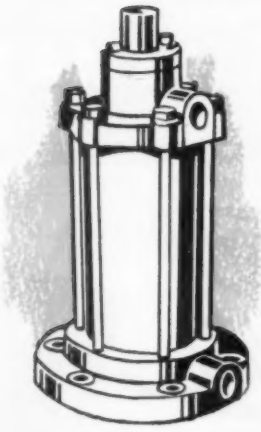
LOGAN . . . a national participant in major fluid power advancements

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Rose Bowl New Year's Day playoff . . . great classic of one of the nation's most popular sports activities.

LOGAN HYDRAULIC CYLINDERS



750 SERIES
NONROTATING TYPE
7 STANDARD MOUNTINGS

Eight standard sizes from 2" to 8" diameter bore. Maximum operating pressure 750 p.s.i.

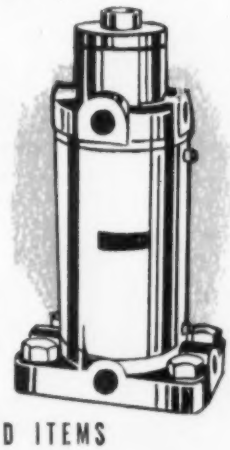
ROTATING "HR" TYPE

Seven standard sizes from 3" to 14" diameter bore. Maximum operating pressure 500 p.s.i.

ROTOCAST® SERIES
7 STANDARD MOUNTINGS

Sizes from 2" to 8" bore; any length stroke up to 8 feet as standard. Four piston rod end types. Operating pressures to 1500 p.s.i.

Consult Logan for your special heavy-duty, mill-type cylinder requirements



LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 . AIR CHUCKS, Cat. 70-1 . AIR CYLINDERS, Cat. 100-1 . AIR-DRAULIC CYLINDERS, Cat. 100-3
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SAVES TIME
Logan
AIR AND HYDRAULIC EQUIPMENT
EFFORT • MOTION

LOGANSPORT MACHINE CO., INC., 839 CENTER AVE., LOGANSPORT, IND.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-221



Now in its 6th year

NOPAK Shelf-Stock Service...

based on these 2 Standard Mounting, Class 1, Cushioned Cylinders

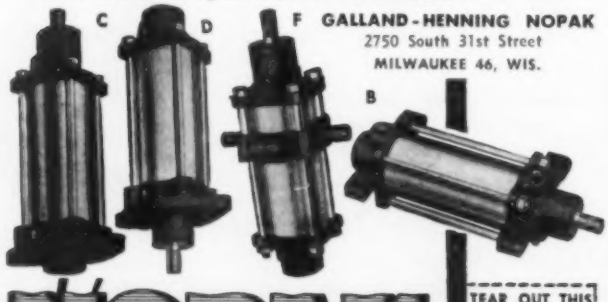
LIST PRICES F.O.B. Milwaukee, Wisconsin

STOCK STROKE LENGTHS — Double Acting Cylinders									
Cyl. Dia. Bore	1"	2"	3"	4"	6"	8"	10"	12"	15"
1½"	24.16	25.72	26.08	26.44	27.16	27.88	28.60	29.32	30.40
2"	26.24	27.88	28.32	28.76	29.64	30.52	31.40	32.28	33.60
2½"	32.36	34.12	34.68	35.24	36.36	37.48	38.60	39.72	41.40
3"	35.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	48.96	51.92	52.88	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
8"	———	126.80	129.20	131.60	136.40	141.20	146.00	150.80	158.00

By specifying NOPAK Shelf-stock, you buy quality cylinders at the lowest possible prices, you eliminate waiting for "specials", reduce engineering costs. Compare the prices and scope of NOPAK Shelf-stock (1½ x 1" to 8 x 15") with competitive offerings — and you will specify NOPAK.

● Basic mountings "A" or "E" convertible to "B", "C", "D" or "F", (see below) by changing cylinder heads. Add 10% to above prices, (no extra charge 8" bore). ● Piston Rods NF male thread. ● Cushioning can be eliminated on rod, blank or both ends by removing spring and ball-check.

NOPAK 4-Way Valves, hand, foot, solenoid, or pilot operated, to actuate all cylinders, also in Shelf-stock.



GALLAND-HENNING NOPAK
2750 South 31st Street
MILWAUKEE 46, WIS.

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

TEAR OUT THIS AD for Reference — or write for extra copies.

A 8003–½

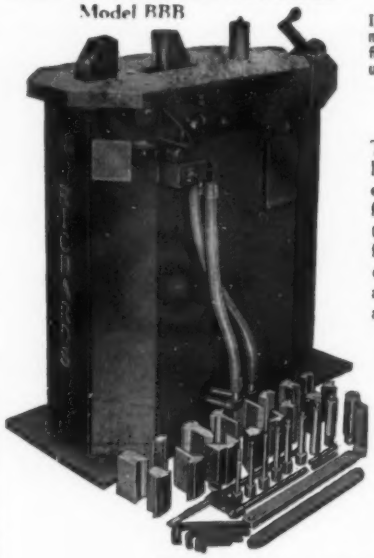
USE READER SERVICE CARD; INDICATE A-8-222-1

Multiform

BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BBB





Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅜"x1½" material.

Send for illustrated folder TE-5

905 North Pitcher St.
Kalamazoo, Michigan

J. A. RICHARDS CO.

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Precision PLUS!!

INTERNAL GROOVE GAGES



Greater Accuracy
Faster Operation • Easier Reading

for THREAD RELIEFS • "O" RING GROOVES • SNAP RING GROOVES

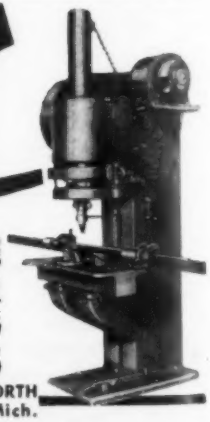
Positive Accuracy assured with readings to less than ± .0001". Faster, easier readings with large 2" Indicator Dial. Ranges from .300" to 6.000". Inreach to 30". Simple setting with outside micrometer or gage blocks. Lightweight. WRITE TODAY!!

RIMAT TOOL COMPANY
21 W. Dayton St., Dept. TE-
PASADENA 2, CALIF.

USE READER SERVICE CARD; INDICATE A-8-222-3

YOU'LL GET MORE PARTS PER HOUR with a...

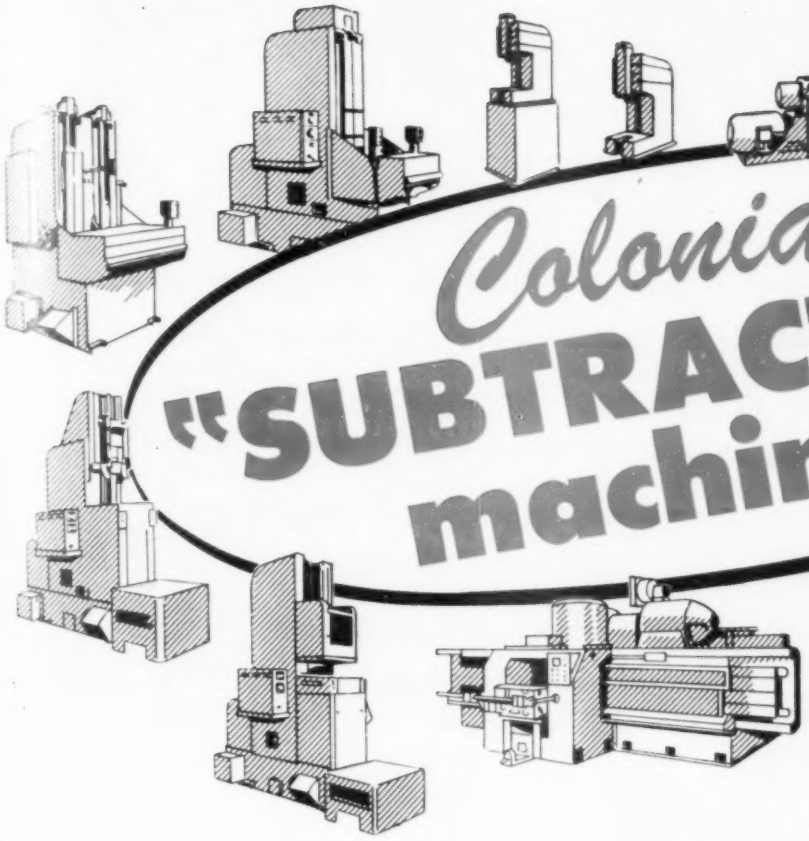
General



FLEXIBLE POWER STRAIGHTENING PRESS

General Manufacturing Co. 6435 FARNSWORTH DETROIT 11, Mich.

USE READER SERVICE CARD; INDICATE A-8-222-4



Colonial "SUBTRACTING" machines

they subtract production costs ... add to profits

Subtraction #1—the *Broach.* With the Colonial broach designed specifically to broach the part efficiently to the tolerances specified at the required rate of production, cost subtraction starts.

Subtraction #2—the *Machine.* Selecting one of the more than 60 dependable Colonial broaching machines capable of handling the broach at the specified rate of production is the next important step in subtracting costs.

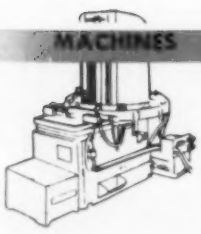
Subtraction #3—the *Fixture.* The Colonial fixture, locating and clamping the part in broaching position, while at the same time permitting maximum accessibility for loading and unloading, is another important step in cost subtraction.

Subtraction #4—the *Automation.* Where high production requirements make loading and unloading time an important factor, the Colonial automation of the broaching instaliation will serve to further subtract machining costs.

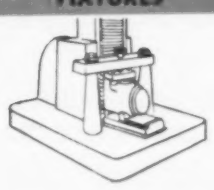
ADDITION—By adding the four important Colonial cost subtracting features above, today's cost conscious metalworking plant has a complete *Colonial Unified Broaching Installation* capable of producing the part at lowest possible cost with utmost accuracy. To subtract costs and add to profits in your plant, ask Colonial Broach to quote on Unified Broaching installations for your parts.

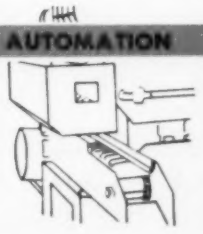
Ask for bulletin 877 on complete line of Colonial broaching machines

MACHINES BROACHES FIXTURES AUTOMATION









Unified Broaching

COLONIAL BROACH CO. DETROIT 32

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-223

WEJ-LOK

a new and different tool holder

of rugged design, simple to use,

positive locking and

universal application



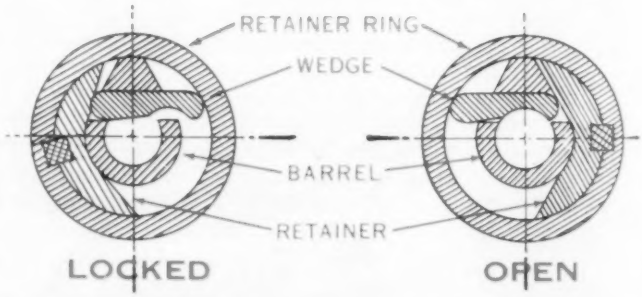
A simple hand spinning of the Wej-Lok retainer ring locks or unlocks inserted tools. Yet, either left or right-hand cutting tools are firmly held by this accurately machined tool holder.

In locked position, the flat surface of holder wedge is tightly seated in mating notched section of tool shank. Normal operating torque tends to further tighten this wedging action, thus, preventing all possibility of tool play or wobble. Where unusually large tools or extra heavy cutting operations are required, provision is made on the holder for use of a Baker drive to augment wedge locking and assure utmost stability.

Wej-Lok tool holder permits universal usage . . . grinding a simple flat area on any tool shank to match holder wedge provides positive locking. You will find Wej-Lok superior in every respect on all drilling, reaming, boring and milling operations.

Note these unusual Wej-Lok features:

1. Shank and barrel machined from one piece.
2. Accurately machined to exacting tolerances.
3. Finest quality hardened steel used in all parts.
4. Long-life through elimination of wear areas.
5. Positive wedge type locking of tools.
6. Wedge lock plus Baker drive on larger tools.
7. Simple insertion and removal of tools.
8. Can be used for right or left-hand cutting tools.
9. All tools quickly ground for use in holder.
10. Designed for standard straight shank end mills.



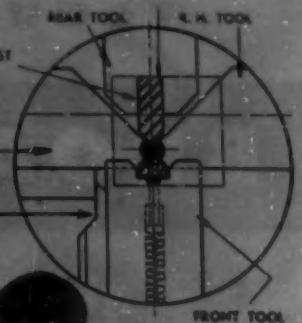
DETROIT REAMER & TOOL CO.

2830 EAST SEVEN MILE ROAD • DETROIT 34, MICHIGAN

D R & T COMPANY

Formed Metal Stampings





Produced Complete in the U. S. MULTI-SLIDE®



ACTUAL SIZE OF METAL STAMPING



The electrical part shown actual size at the left is produced from coil stock—complete, without further handling—at a speed of 140 per minute in the No. 28 U. S. Multi-Slide®. Another example of the advantages of the U. S. Multi-Slide for the precision fabrication of many types of metal parts calling for piercing . . . blanking . . . forming . . . swaging . . . embossing and similar operations!

The part illustrated is made of phosphor bronze .025" thick, and the sequence of operations is as follows: pierce 3 holes; trim top and bottom; shear on bottom; preform; cut off; finish form. The last operation is shown in detail in the profile view within the circle above.

In addition to eliminating costly secondary operations, U. S. Multi-Slides save manpower, too. A single operator can attend a battery of Multi-Slides, since the operation is entirely automatic. Operator merely loads coils of material onto a stock reel for feeding into the machine.

U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-225

reduce that part cost . . .

BROACH IT the *American* way

Broaching is a metal-cutting process that will remove stock to precision limits faster than any other metal-cutting process known — and will maintain those precision limits throughout production runs.

Below are a few jobs that have been done with American broaching tools and machines.



Broach and burnish round holes in refrigerator hub parts.



Broach splines and hole in automobile bevel gear.



Broach seven external slots in pump rotor part.



Broach jig pads and bolt seats on automotive connecting rods and caps.



Broach involute teeth and cam surface of gear part.



Regardless of how simple or complex your broaching application may be, American can furnish you broaching tools to meet your requirements in part tolerance and finish.

In addition to making all types of broaching tools, American builds broaching machines and fixtures, giving you a well-rounded manufacturing service. American backs up its products with a strong service organization that makes certain broaches, fixtures and machines installed by American will do the job for you.

So why not let American help solve your machining problems. Just send a part print or sample for a free estimate.

Write for Catalog 450. It describes American broaches, machines and fixtures.



AMERICAN *American* BROACH & MACHINE CO.

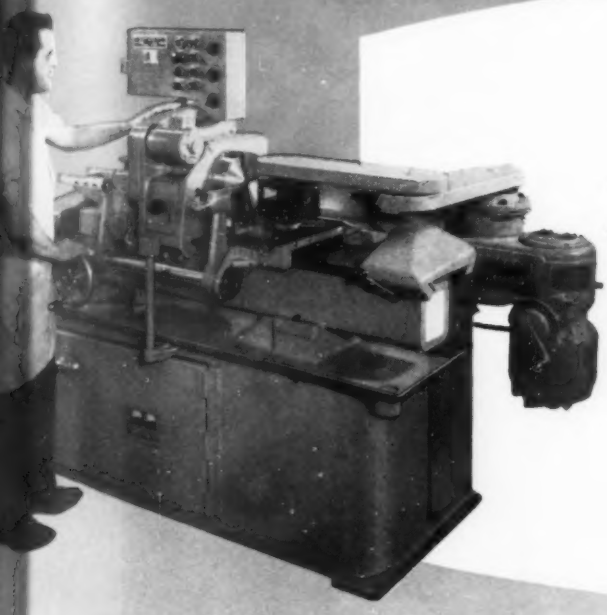
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

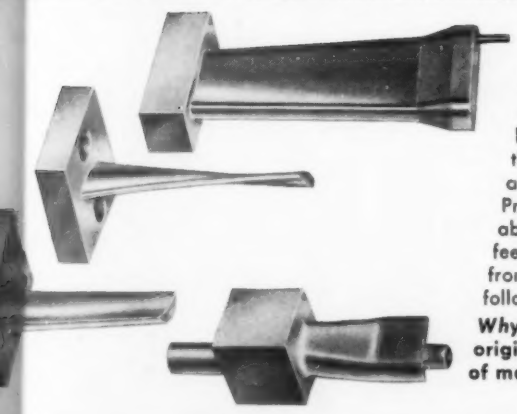
See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

NOW FIRST TO PRODUCE ORIGINAL 3-DIMENSIONAL AIRFOIL SHAPES



- WORKING DIRECTLY FROM SIMPLE CROSS-SECTIONAL TEMPLATES AND DATA ON AIRFOIL DRAWING
- WITH AUTOMATIC INTERPOLATION—TRUE FAIRING BETWEEN AND BEYOND THE CROSS-SECTIONAL STATIONS
- WITH NON-CONTACTING TRACER CONTROL
- PRECISION MACHINED
- IN HOURS INSTEAD OF WEEKS

NEW MODEL 102 electronic AIRFOIL MILLING MACHINE



Heretofore original masters were made by hand — no generating method being available. Now, in a matter of hours rather than weeks, the first master can be produced — hours in a single machine rather than weeks of skilled bench work. Simple templates, made to represent designer's airfoil cross-sections, together with data on drawing, are the only "special tools" needed by the machine. True fairing between and beyond the designated cross-sections is automatically produced by the machine interpolation systems. *True* fairing of shape and of twist-of-shape is accomplished automatically.

Principal motions of workpiece during generation of master airfoil are: (1) rotation about axis, (2) high-speed motion of milling head to and from axis, and (3) slow feed of milling head parallel to axis. Signals to produce motion (2) are obtained from the completely new NON-CONTACTING tracer control, which always exactly follows, *but never contacts* the constantly changing interpolation "flexure".

Why not use *this method* to generate the whole airfoil surface on your original airfoil masters — and, in addition, to provide a convenient means of machining pilot production runs?



USE THIS COUPON TO SEND FOR COMPLETE INFORMATION

MANUFACTURED BY THE NEW ENGLAND MACHINE & TOOL COMPANY
... and Complete Sales Engineering and Maintenance Service ... Exclusively Through

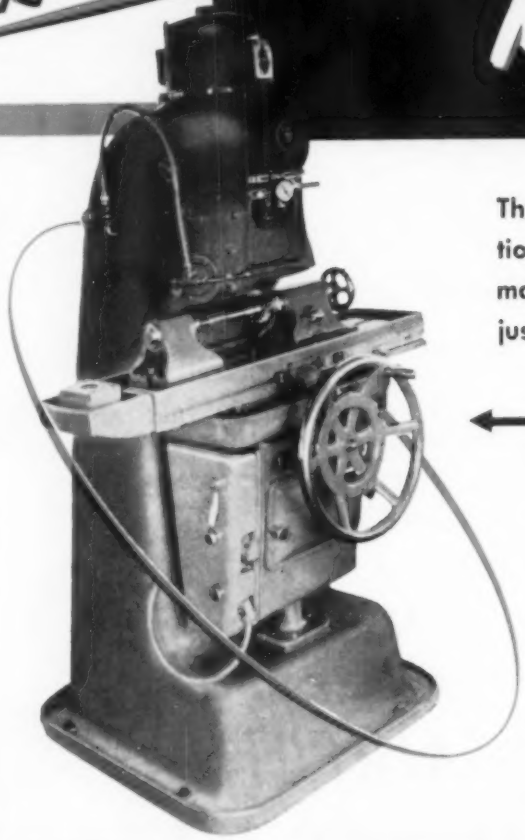
PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U.S.A.
SINCE 1860
First Choice for Accuracy
BRANCH OFFICES IN PRINCIPAL CITIES
MACHINE TOOLS • CUTTING TOOLS • GAGES

PRATT & WHITNEY — DIV. NILES-BEMENT-POND CO.
16 Charter Oak Blvd., West Hartford 1, Conn.

Please send my free copy of Circular No. 575 fully describing the new Model 102 Airfoil Milling Machine.

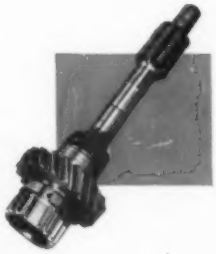
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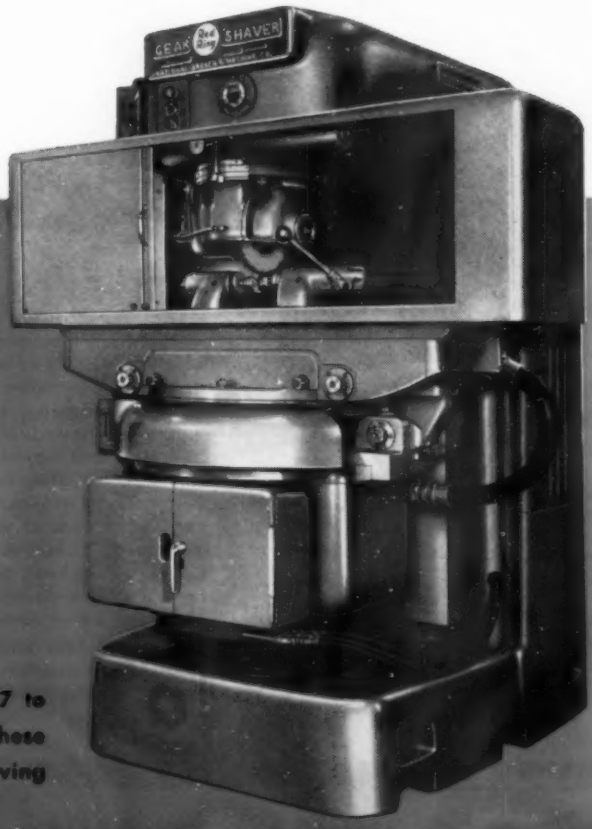
NOW IS THE TIME TO Cut Manufacturing Costs



The one sure way of meeting today's competition is with today's machine tools. The older machines were all right in their day but they just haven't got what it takes now.

← **For instance,** it took this old Red Ring Model GCC 60 seconds to shave a gear like the one shown. →





Model GCU today finishes that same gear in just 16 seconds—and to much closer tolerances, too.

In an 8 hour day the GCU will deliver 375% of the production of its predecessor.

Write for Bulletin S 53-7 to get all the facts on these new cost saving gear shaving machines.

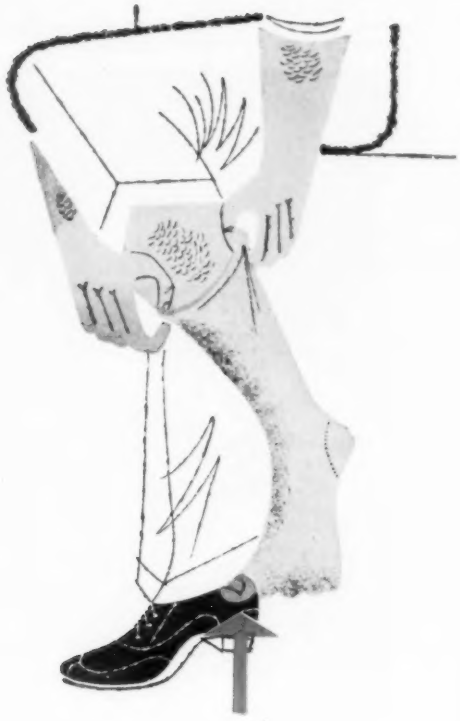


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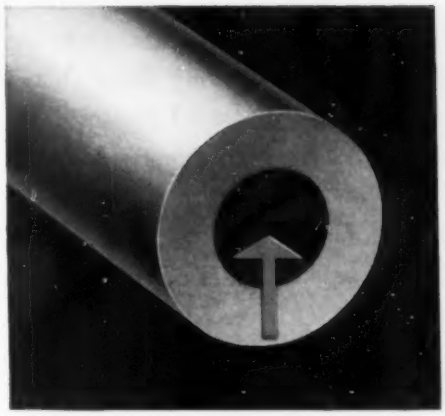
NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



a hole here is a nuisance...



a hole here is an advantage

Crucible Hollow Tool Steel Bars are saving time and money for more and more members of the metalworking industry. By using these hollow bars you eliminate drilling and boring operations, increase machine capacity and cut scrap losses.

Now, you can get hollow bars of any of Crucible's famous tool steel grades, in almost any combination of O.D. and I.D. sizes. And you can get *immediate* delivery of five popular grades from your local Crucible warehouse—KETOS® oil-hardening, SANDERSON® water-hardening, AIRDI 150® high carbon—high chromium, AIRKOOL® air-hardening, and NU DIE V® hot-work tool steels.

Your Crucible representative can point out ways to save time and money by using Crucible Hollow Tool Steel Bars.



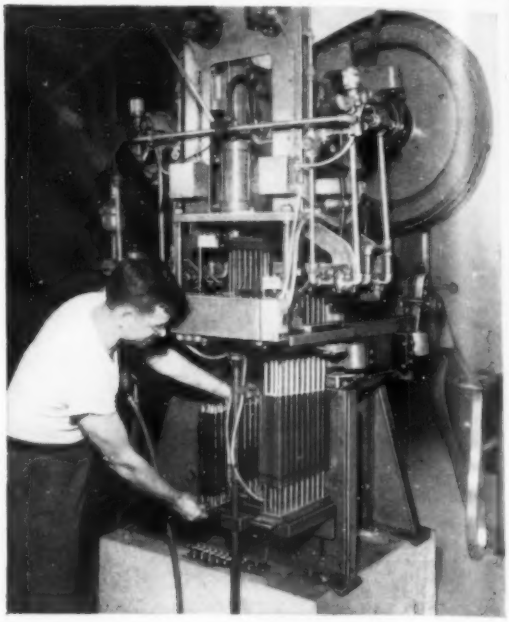
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **HOLLOW TOOL STEEL**

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-229

At the York Corporation plant this V & O corrugates, punches and flares copper fins; forms spacers; and stacks fins on copper tubes; all on a single machine.



■ Automation needs exceptionally accurate, sturdy, trustworthy production machines. The high cost tooling and complex accessories do not permit anything less.

V & O has known all this for 65 years. The first V & O presses were designed because no others were adequate for automated tooling. The long slides, hand scraped ways, sturdyized features of V & O presses all were created for automation; all have been time-tested on highly automated operations. Our new controls and devices are designed solely for automation.

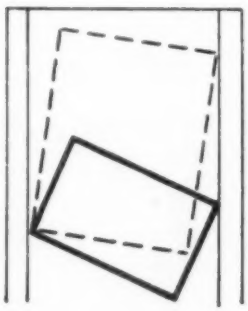
At V & O, automation is not a "new trend" with which to catch up. V & O never has had any other trend. That is why V & O presses can so easily put you ahead of the automation parade.

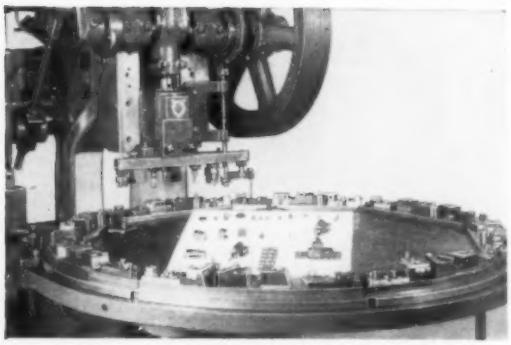
Write for the full story.

why FOLLOW automation?

WHY THE V & O LONG SLIDE PROVIDES BETTER ALIGNMENT

With the same running clearance, the longer the slide the less the possibility for angular misalignment. And we keep our running clearances very close indeed.





Long before the "automation craze" began, this 8 station dial feed V & O assembled the parts shown here, at the rate of 12 assemblies per minute.

THE V & O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

HUDSON, NEW YORK

65th Anniversary

BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

NEW PNEUMATIC CLUTCHES

V & O is now equipping presses with time-tested pneumatic clutches modified to provide improved economy, compactness and simplicity in press operation. They are unusually long-lived, self-ventilated, and designed to operate indefinitely with minimum maintenance. They increase the advantages of automation — and of better tooling.

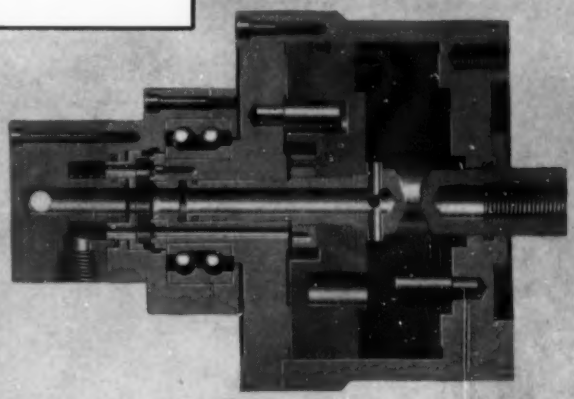
CUSHMAN

gives you CHUCK-ABILITY



CHUCK-ABILITY: **The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right work-holding devices**

Remember–
You can't machine it economically unless you hold it right



an example

. . . is Cushman's comprehensive series of Aluminum Body Cylinders, guaranteed to operate up to 7000 r.p.m. without vibration and with low fly wheel effect. Available from 3¼" to 14" bore size with a stroke from 1" to 2" depending upon the cylinder size. Iron Body Cylinders, available from 8" to 20" bore size with a stroke from 1⅝" to 2", are designed to operate efficiently at speeds specified for modern standard machine tools. Air Swivel Connections for both types of cylinders are made of aluminum with patented air seal designed to hold applied pressure without variation or leakage throughout a long service life. All cylinders are statically balanced and bench tested to eliminate vibration at rated speeds. While Cushman Rotating Air Cylinders have been designed for use with Cushman Air Operated Chucks, they will perform equally well with air chucks of other makes.

Find out what Chuck-Ability can do for you . . . write Cushman for Catalog No. PO-64-1953 fully describing and illustrating Cushman Air Operated Chucks, Cylinders and Accessory Equipment . . . or, should you have a special work-holding problem, consult the Cushman Engineering Department . . .

THE CUSHMAN CHUCK COMPANY

806 Windsor Street **Hartford 2, Connecticut, U.S.A.**

2CS54R

CUSHMAN is CHUCKMAN — CHUCKS AND ACCESSORIES Exclusively — SINCE 1862

Manufacturers of

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.

Ask your Industrial Distributor

A WORLD STANDARD FOR PRECISION

Beaver QUICK-CHANGE VERSATILITY CUTS OPERATIONAL COSTS



No matter what your tool requirements may be — no matter how often tools must be changed—Beaver Quick-Change Tool Holders and Adaptors will save you money.

Beaver's versatile Quick-Change Tooling permits the use of shell mills, face mills, end mills, drills, reamers, boring bars and other desired tools on any Beaver equipped machine without loss of accuracy.

Less than ten seconds per tool change gives you maximum production from each machine. Down-time reduced to an unbelievable minimum.

Beaver Quick-Change Tooling can be installed on most standard machines. Let us show you how it will benefit YOUR machine operations.

Write for our complete catalog #52.

Beaver TOOL AND ENGINEERING CORPORATION

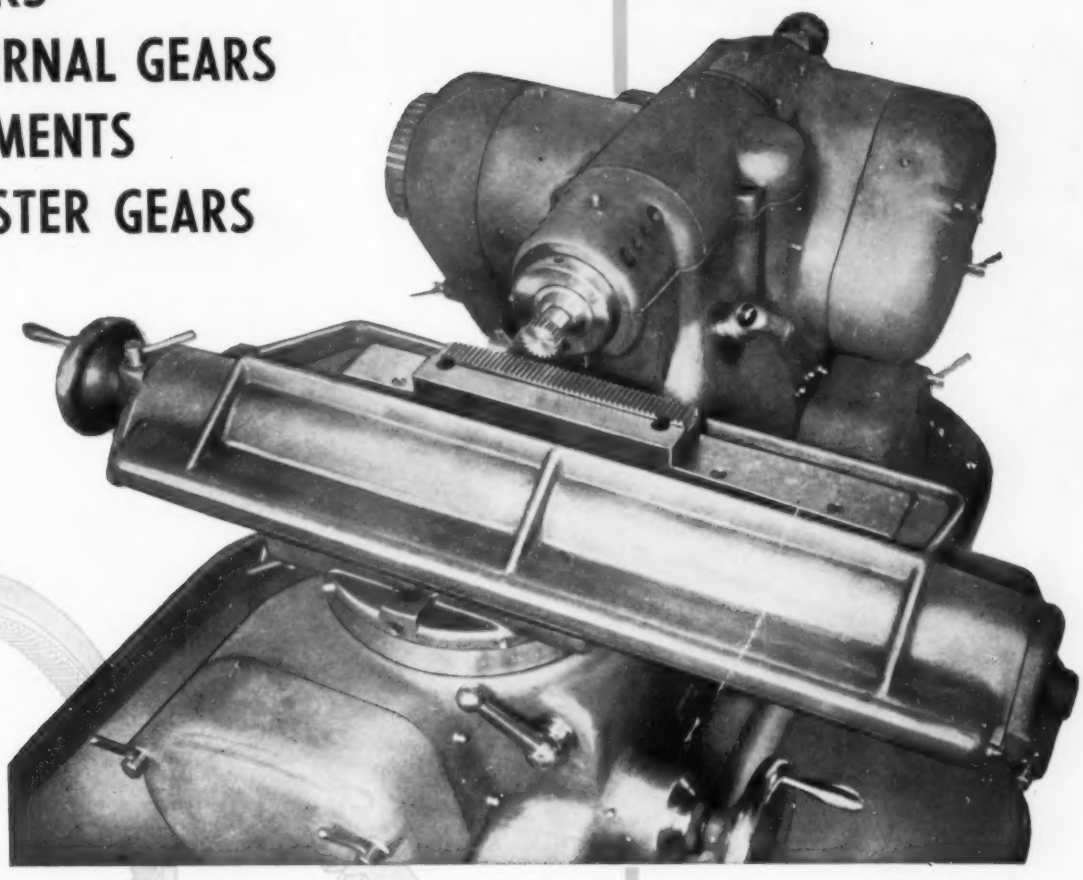
2850 ROCHESTER ROAD • BOX 429, ROYAL OAK, MICH. Teletype - Big Beaver 648



MIKRON *fine pitch*

RACK & GEAR CUTTER NO. 134—
Another machine in the MIKRON line—*Controlled Accuracy. High Finish, Ease of Set-Up.*

- **RACKS**
- **INTERNAL GEARS**
- **SEGMENTS**
- **CLUSTER GEARS**



THE precision cutter shapes as it generates tooth forms. The work meets your most exacting specifications and standards. Gear production requiring a shaping operation will be ideally performed with the MIKRON No. 134.

WORK PIECE CAPACITY

RACKS: (Straight or Skew) to 36" long x 1" wide.

SEGMENTS & CLUSTERS: to 3⅛" dia. x 1" wide.

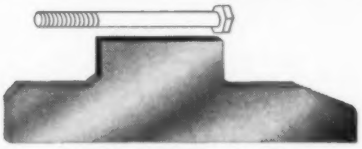
INTERNAL GEAR: to 4" dia. x 1" wide.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

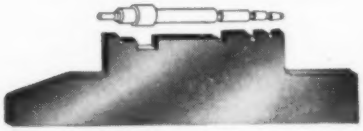


Talide Blades Any Size - Any Shape



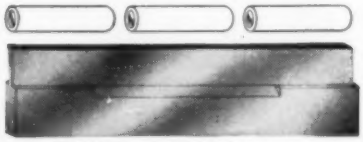
LEADING BOLT MAKER

PART..... Hardened Alloy Steel Stripper Bolt.
OPERATION..... Grind O.D. of bolt body.
MACHINE..... No. 2 Cincinnati Centerless Grinder.
BLADE..... Standard Talide-tipped Infeed work support blade No. 223877.
RESULTS..... Talide-tipped blade gave 1600 hours of continuous service compared with normal production of 20 hours obtained with high-speed steel blade.



LARGE ELECTRIC MOTOR PLANT

PART..... Stainless Steel Rotor Shaft for Electric Motor.
OPERATION..... Grind 7 diameters simultaneously.
MACHINE..... No. 2 Cincinnati Centerless Grinder.
BLADE..... Special multiple step Talide-tipped work support blade No. C-4884.
RESULTS..... Talide-tipped blade in continuous production for 91 days (2 turns per day) compared to best previous production run of 3 days with hard alloy steel blade.



LARGE MID-WEST BUSHING PRODUCER

PART..... Cast Bronze Bushing.
OPERATION..... Grind O.D. of bushing body.
MACHINE..... No. 12 Landis Centerless Grinder.
BLADE..... Standard Talide-tipped thru-feed work support Blade No. CA-32328.
RESULTS..... Talide-tipped blade maintained size without scoring or scratching while grinding 1,000,000 hard bronze bushings—previous Stellite blade wore out after grinding only 40,000.



One-piece Talide strip (up to 100" without seams) prevents scoring and scratching. Write for new 84-page Catalog 54-G or ask for sales engineer to call. Metal Carbides Corporation, Youngstown 7, Ohio.

METAL CARBIDES CORPORATION
MC
TALIDE
YOUNGSTOWN 7, OHIO

SINTERED CARBIDES · HOT PRESSED CARBIDES
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

DE VLIEG OF DETROIT

. . . is proud to reproduce this unsolicited advertisement by American Type Founders as it appeared in nationally circulated technical magazines.

This ad is reproduced through the courtesy of AMERICAN TYPE FOUNDERS



This machine hunts for—and finds—dead center!

This De Vlieg Jigmil is used to locate and bore the cylinder, gear-driven ink rollers, and gear bearing holes in ATF Chief frames.

Once the adjustments have been set, the Jigmil automatically positions every subsequent frame by moving its machine table or spindle head until the desired center is located to within 3-5/10,000ths of an inch. Then this 12-ton precision borer is micrometer-set so accurately that it will remove a pencil mark from a boring without cutting the metal.

Bearing holes not so accurately located on the press frame could easily throw cylinders out of parallel, cause excessive wear to precision gears, make smooth high-speed operation impossible and take years off the productive life of a press.

That's what we mean when we talk about the precision engineering that goes into an ATF Chief. You won't find more accurate borings in any press regardless of price. It's like getting Cadillac construction for Chevrolet prices.

It will pay you well, next time you're in the market for a small offset press, to ask for the full story on the precision-engineered ATF Chief. Write AMERICAN TYPE FOUNDERS, *a subsidiary of Daystrom, Inc.*, 200 Elmora Avenue, Elizabeth, New Jersey.



Better, More Profitable Printing from the Widest Line of Processes

GRAVURE . . . LETTERPRESS . . . OFFSET

Come to Detroit . . . SEE A PRACTICAL DEMONSTRATION OF "JIGLESS BORING"

DE VLIEG MACHINE COMPANY • 450 Fair Ave., Ferndale • Detroit 20, Michigan

A request on your company letterhead will bring a copy of our comprehensive illustrated catalog.

INVESTMENT-CASTINGS

Supply the solution to many an otherwise difficult PRODUCTION PROBLEM.

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BERYLLIUM COPPER



CARBON STEELS
ALLOY STEELS-STELLITE'S

The above parts present an ideal one to be produced by the INVESTMENT CASTING PROCESS. The general construction is such that normal production machining procedure can not be utilized, and add to this the fact that the material is 440-C STAINLESS STEEL, a very tough metal to machine.

This item produced as a machined part, would entail costs of from 4 to 5 times the price incurred in producing it as an INVESTMENT CASTING.

Send us your part prints, and let our engineers furnish you figures that will show you the savings. We have done it for many others, so let's see if we can do it for you.

Ask for our free literature on Why's and Wherefore's in the INVESTMENT CASTING BUSINESS.

CADMET CORPORATION
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USE READER SERVICE CARD; INDICATE A-8-236-1

Drill Hardened Steels without Annealing—



With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon–high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—With "HARDSTEEL"

BLACK DRILL COMPANY, INC.
1414 East 222nd St. • Cleveland 17, Ohio

Also makers of— BLACK DRILLING UNITS—AUTOMATIC, SELF-CONTAINED—FOR COST-CUTTING PRODUCTION ON ALL MATERIALS *Write for information*

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LASSY

TAPPERS

New! Exclusive Features

Set new standards for cut thread accuracy. Are universally used in the Tool Room and for small lot production. No set up. Always ready for instant use.

LASSY TOOL CO.
Plainville, Conn.

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DYKEM STEEL BLUE®

Stops Losses making Dies and Templates



Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

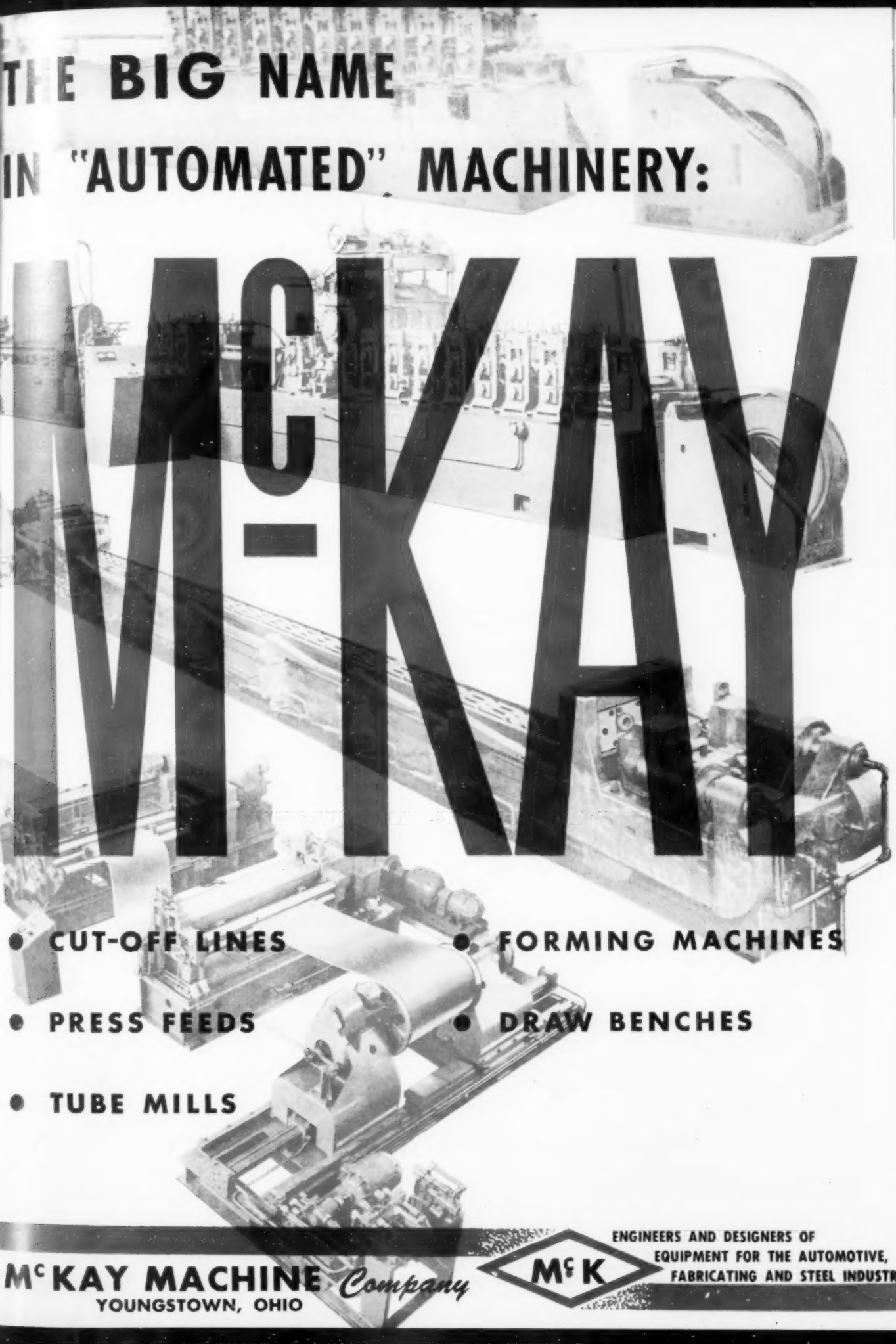
THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

USE READER SERVICE CARD; INDICATE A-8-236-4

THE BIG NAME

IN "AUTOMATED" MACHINERY:

McKAY



- CUT-OFF LINES
- FORMING MACHINES
- PRESS FEEDS
- DRAW BENCHES
- TUBE MILLS

McKAY MACHINE Company
YOUNGSTOWN, OHIO

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ENGINEERS AND DESIGNERS OF
EQUIPMENT FOR THE AUTOMOTIVE,
FABRICATING AND STEEL INDUSTRI

ERICKSON INDEXERS

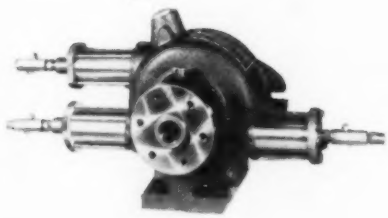
One of these *three* types will answer your AUTOMATIC POSITIONING needs for MILLING, DRILLING, TAPPING, WELDING and many ASSEMBLY OPERATIONS

EXCLUSIVE ERICKSON INDEXER FEATURES:

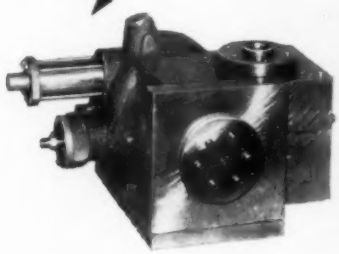
- Index mechanically locked by spring-loaded pin
- Integral shock control unit prevents over-ride
- Three-position indexer available for 120° locating
- Up to 500 positions can be indexed accurately
- Reasonably priced due to ingenious design
- Index plate is easily changed
- Can be operated at any angle
- Operates by air or hydraulics



MODEL 450 ERICKSON SPEED INDEXER is designed for vertical operation. Extra large drive spindle rides on Timken roller bearings at top and bottom of spindle and permits handling of larger and heavier work. This model is suggested for installations where limited height is a factor.



MODELS 400 and 600 ERICKSON SPEED INDEXERS Standard index plate provides 4, 6, 8, 12 and 24 positions. Special indexing parts are available to provide up to 100 positions. Two mounting surfaces provide for vertical or horizontal mounting.



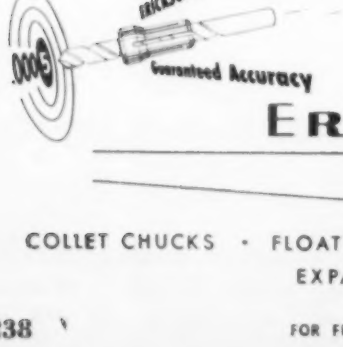
MODEL 477 ERICKSON MULTIPLE POSITION INDEXER accurately indexes up to 500 positions, depending on the gear ratio and index plate employed. Since gear box turns on indexer spindle, unit can be operated in any angle from 0 to 90°. Units are made to customers' requirements.

You can speed up and simplify accurate positioning with Erickson Speed Indexers. For fully automatic operation interlock them in your production line by use of micro switches and solenoid valves. They are designed for single or continuous cycle operation.

All Erickson Indexers feature an adjustable, self-contained shock control unit that assures positive, fast indexing even under heavy load. Maximum speed can be used with no over-ride.

A hardened and ground lock pin operates independently of actuating mechanism to assure positive positioning accuracy within 2 minutes of a degree.

A-9912



Accurate Automatic Positioning Cuts Costs...

Write for Erickson Catalog K today! You'll find many interesting applications for all Erickson holding tools. Take advantage of our free engineering service. An Erickson field engineer will gladly work with you for production economy.



ERICKSON TOOL COMPANY

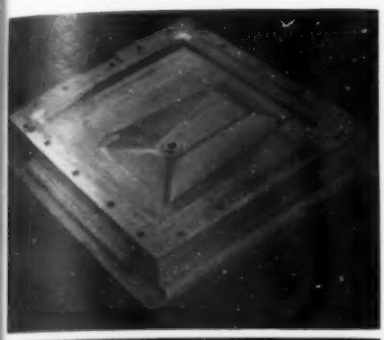
2303-A Hamilton Avenue • Cleveland 14, Ohio

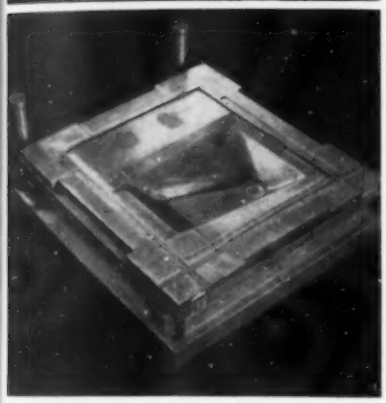
COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • SPECIAL HOLDING FIXTURES

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation





Top and bottom sections of drawing die, made of BTR, which was used in manufacture of the water-fountain top illustrated at right.

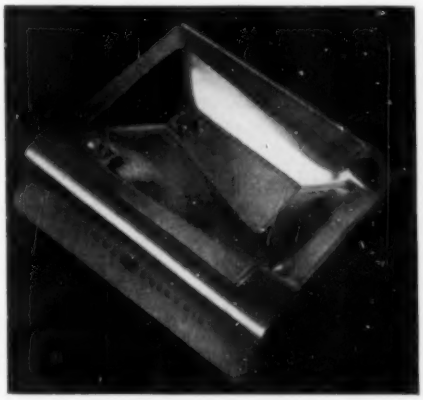
Die Draws 25,000 Stainless Pieces Without Showing Any Wear

The oblong section shown at right, a stainless-steel top for an electric water fountain, is one of a vast array of interesting specialty products being turned out by L. F. Grammes & Sons, Inc., Allentown, Pa.

To manufacture this part economically, engineers at the Grammes plant required a die having good wear-resistance, low distortion and good resistance to shock. What's more, they also wanted a tool steel that was both easy to machine and heat-treat.

BTR (Bethlehem Tool Room) was selected for the drawing die, which was hardened to Rockwell C-60 before being put to work in a 200-ton press. It's been giving a good account of itself, too. At last report, some 25,000 water-fountain tops had been produced, without any sign of die-wear.

BTR is a tough steel, with outstanding resistance to abrasion. You'll find it ideal in every way for many intricate tool-and-die applications.



BTR is our general-purpose type of oil-hardening tool steel, and has this typical analysis:

Carbon	0.90	Chromium	0.50
Manganese	1.20	Vanadium	0.20
		Tungsten	0.50

BETHLEHEM TOOL STEEL ENGINEER SAYS:

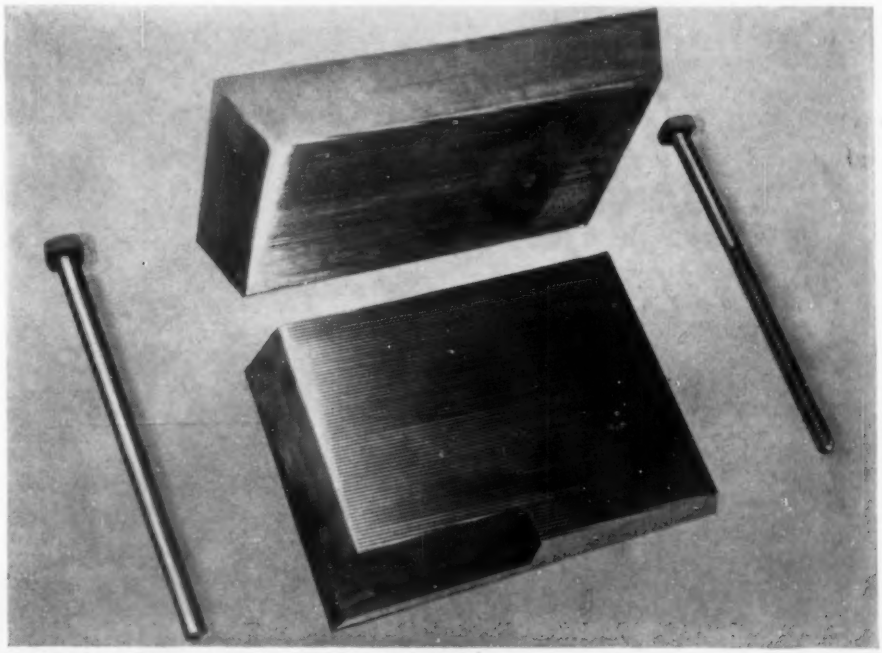


Don't Overlook the Interrupted Quench

One hears such a lot these days about isothermal annealing, martempering, automatic heat-treatment furnaces and a host of other modern processes that it is easy to overlook some of the old-time procedures which are still useful. For example, the interrupted quench.

An interrupted quench involves quenching a tool in water, then removing it from the water before the hardening transformation has started, and finishing the quench in oil. The tools should be removed from the oil while still warm, and should be tempered immediately. On water-hardening steels, an interrupted quench permits hardening of intricate sections which might crack if water-quenched all the way.

With oil-hardening steels, the interrupted quench permits hardening of sections which are too large to harden properly if oil-quenched all the way. At the same time this practice avoids the cracking which might possibly occur if a straight water quench were used.



THREAD-ROLLER DIES MADE OF LEHIGH H. These thread-roller dies, used in the manufacture of machine bolts, are made of Lehigh H, our air-hardening type of high-carbon, high-chromium tool steel. They have a Rockwell C hardness of 58-60. Lehigh H is resistant to wear, and has exceptionally high compressive strength, enabling threads to be cold-rolled on thousands of pieces before redressing is required.

Here's THE SOLUTION OF A DAILY PROBLEM!



How to make set-ups for tapping and reaming without wasting valuable time and yet have them accurate enough to insure perfect work is an ever-recurring problem. It can be quickly solved, however, by doing nothing more than changing tool holders.

Take the Ziegler Holder, for example. With it all you have to do is to align the work within 1/32" of accuracy on the radius (1/16" on the diameter) and the holder automatically corrects the inaccuracy.

Think of the time you can save by following this modern method of spindle alignment! And, of course, time saved means money saved!

W. M. ZIEGLER TOOL COMPANY
13574 AUBURN DETROIT 23, MICH.

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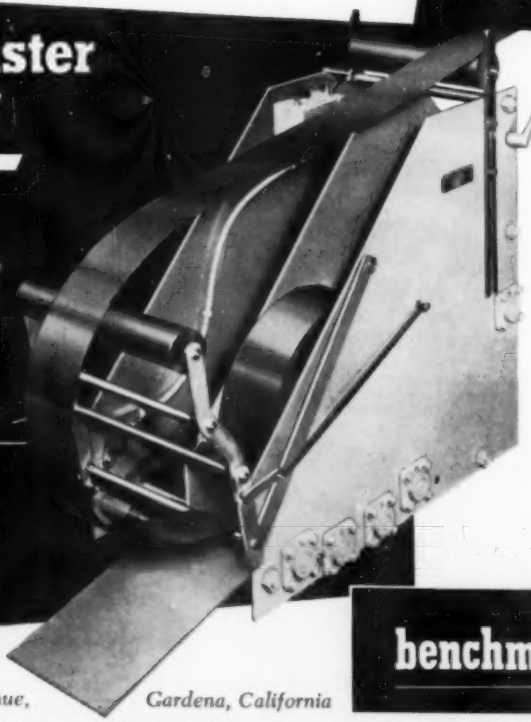
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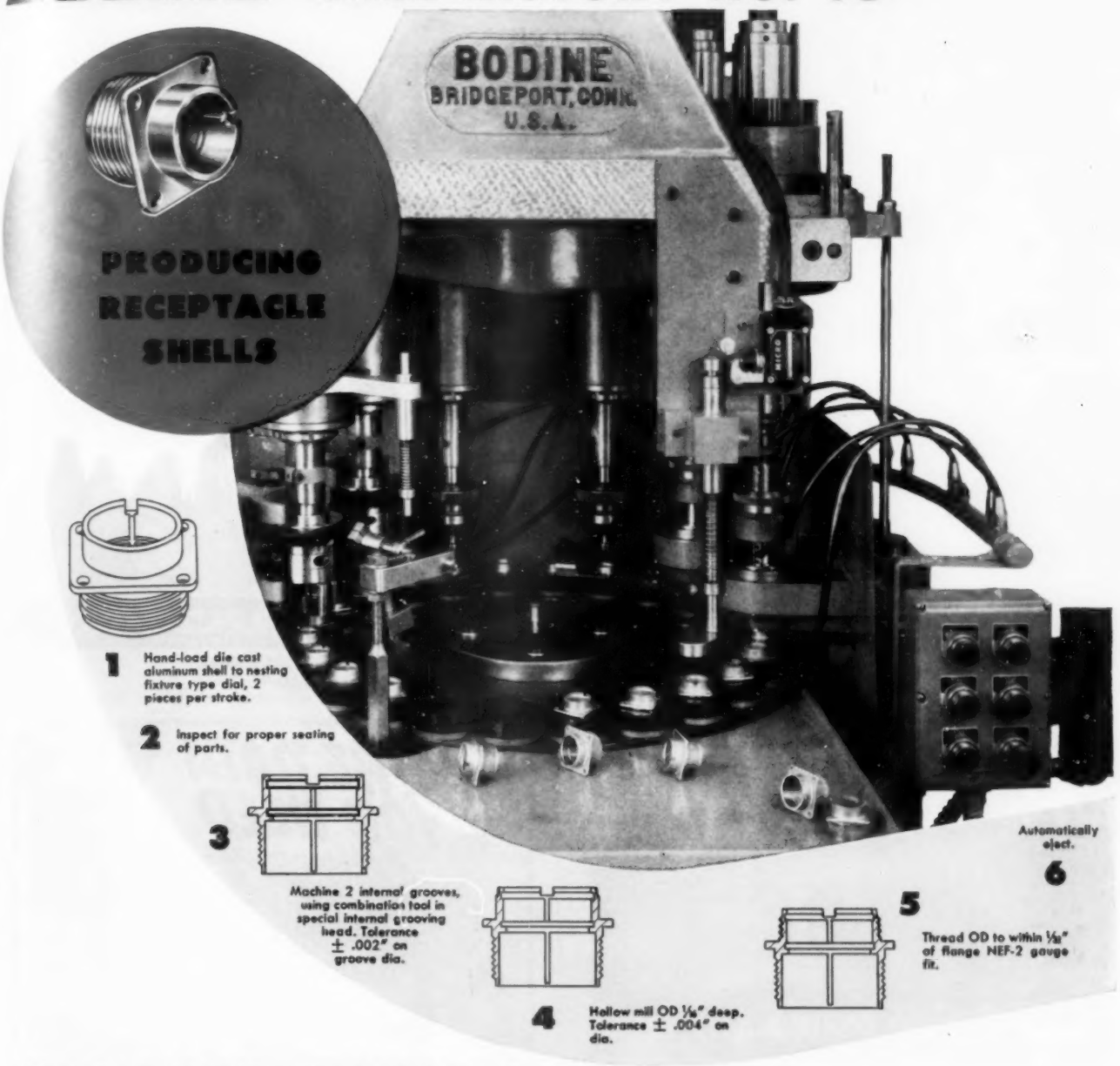
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Bodine CASE HISTORY NO. 38



This Bodine Model 48-30 machine is tooled to handle 13 receptacle shells ranging from 7/16-27 to 1 5/8-18 NEF 2 threads. Shells are used for multiple terminals in TV, Radar, etc.

PRODUCTION: From 1,600 to 2,200 pieces per 50-minute hour, depending on size of shell.

Potentiometers next to push button station regulate two electronically controlled variable speed motors. Positive, accurate control over spindle rpm and over rate of feed gives lead-screw accuracy to the threads with a non-reversing spindle.

Bodine machines (of four types) may be tooled for an extremely wide variety of high speed repetitive production jobs . . . including drilling, tapping, threading, screw inserting, light milling, and assembly. For a true picture of cost cutting, write Dept. TE-8 for our brochure "Bodine Presents 12 Typical Case Histories."

"You Can't Meet Tomorrow's Competition with Yesterday's Machine Tools."

THE
Bodine
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AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

6BD54



A NEW TOOL with floating, self-centering feature designed to compensate for any center misalignment.

Simple and easy to adjust, its design permits knurling and thread rolling close to the collet.

Developed for single spindle automatics, this tool can be used on either front or rear cross slide. It is also adaptable to multiples, hand screw machines and turret lathes.

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New Noburmatics deburr and chamfer front and inaccessible back hole faces in ferrous and non-ferrous sheets, plates, extrusions, castings and forgings ***in one automatic operation***. Used in drill motors or stationary machine tools, Noburmatics produce uniform deburring with high accuracy, increase production line speed. Made in all drill sizes from 1/8" (.125) to F(.256).



Entry Noburmatic enters hole, advances to limit stop, DEBURRS FRONT FACE. (Rear cutter now projects.)



Withdrawal BACK FACE DEBURRED. Cutter automatically retracts. Tool ready for next cycle.

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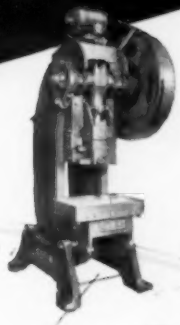


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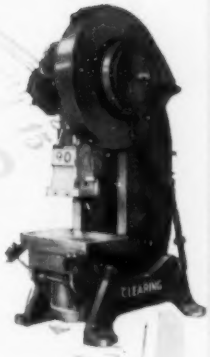
75 ton

A New Manufacturing Policy on Clearing O.B.I.'s

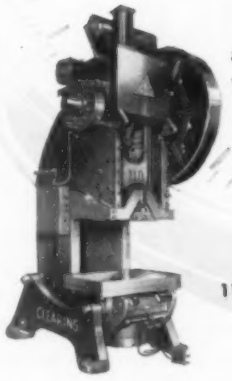
Here is another Clearing first. Presses manufactured in advance of sale! Clearing inclinables in practically every capacity are now immediately available for shipment upon order. This time-saving manufacturing and sales policy has been undertaken by Clearing Machine Corporation to take the usual lag out of delivery.

Our Hamilton plant has been tooled up exclusively for producing O.B.I.'s. This step was taken originally to speed up delivery; however, many customers indicated a desire for even faster service. The result has been this new approach to press manufacturing—one which we feel will be well worthwhile in terms of customer satisfaction.

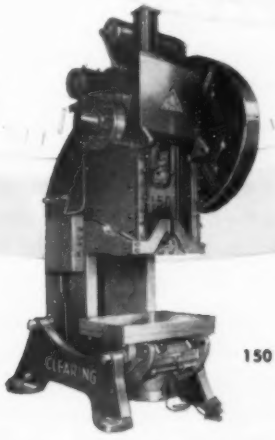
If you have been considering the purchase of an O.B.I. press, take advantage of this new production and delivery policy. Get in touch with Clearing by mail or telephone today.



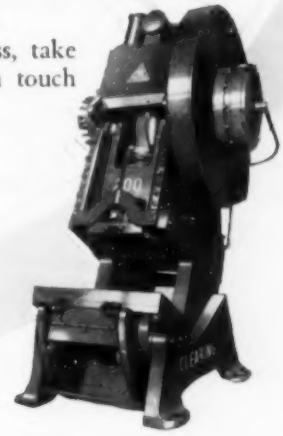
90 ton



110 ton



150 ton



200 ton



New catalog gives complete size and tonnage specifications on Clearing O.B.I.'s. Just drop us a line. We'll mail it immediately at no obligation.

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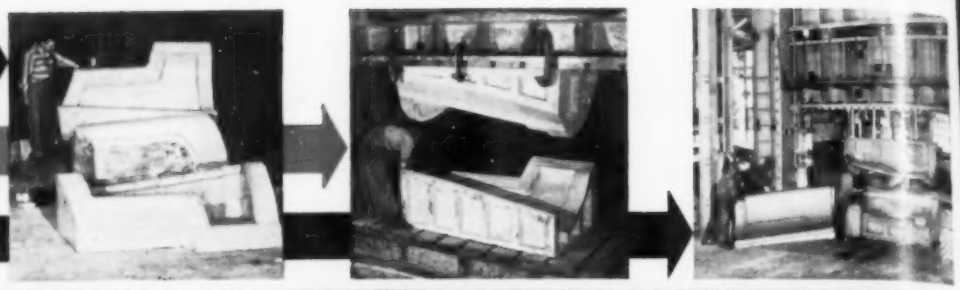
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The PATTERN

The DIE

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It's Allied that offers the *complete* service to provide you with die-made prototype parts.

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If you need sheet metal stampings for prototype assemblies, you should investigate Allied's all-inclusive service. A visit to our Plant 4 in Hillsdale, Michigan will convince you that here is a positive method of insuring an economical and rapid transition from prototype to high volume production. If a visit is not convenient, let us supply you with complete information.

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Crucible has been making REX® High Speed Steels for over half a century . . . and REX is still the standard of comparison wherever high speed steels are used. That's no idle claim . . . and you can prove REX's superiority for yourself by putting a piece to work in your own shop. You'll like its hardenability, response to heat treatment, and good tool performance.

Once you've tried it, we think you'll agree — *you can't find a high speed steel that will outperform REX.*

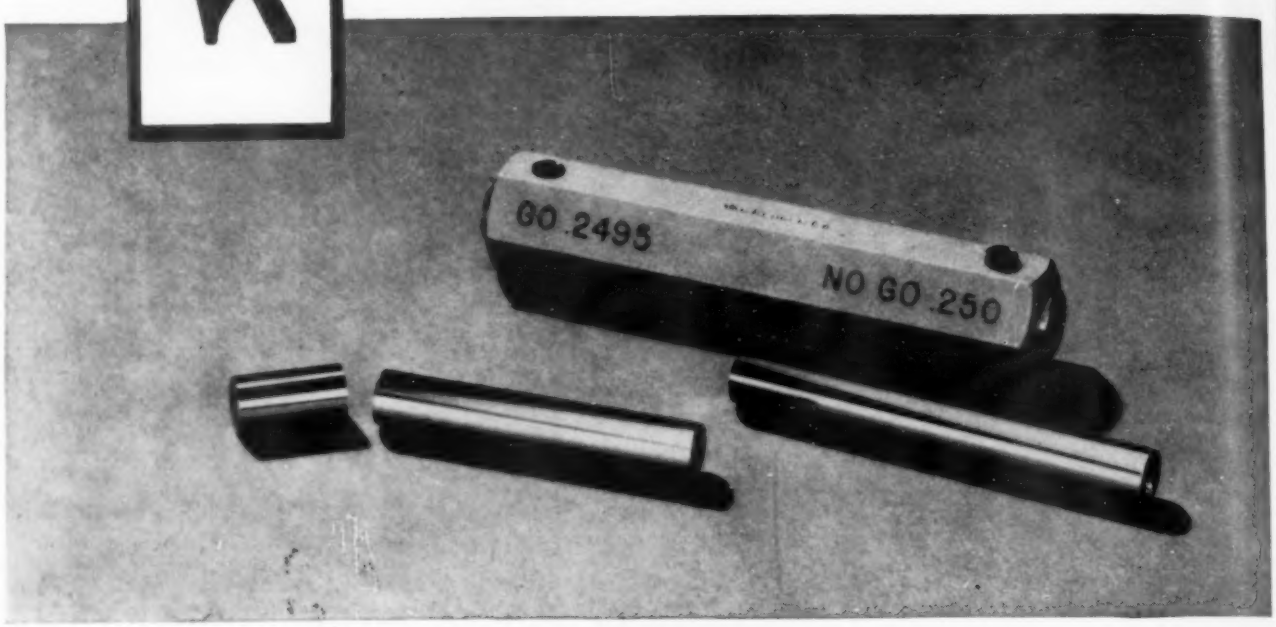


CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

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VASTLY LONGER-LIVED and MONEY SAVERS . . . because they're "Cut-Off-Able" as well as "Reversible"

As a Van Keuren agent put it, "They're not only reversible, they're cut-off-able." And that means when you buy Van Keuren Wire Type Plug Gages, the sizes below 3/8" may be cut off when ends become worn and as many as from five to ten gages made available from the 1 7/8" and 2" long units. It is not only economical and practical to use Van Keuren Gages but it is a very simple operation to cut off the ends by following instructions furnished on request. The illustration above shows clearly the cut-off and reversible features.

VK Wire Type Gages are available in ZZ to XX accuracies in sizes from .001" to 1.000". They are furnished in alloy tool steel, high speed steel, chromium plate or tungsten carbide. Whatever the gaging job, the extra length provided in VK units will save you money. It will also pay you to take advantage of VK deliveries. In many cases we can ship your requirements from stock.

VK Wire Type Plug Gages are fully described in Catalog & Hand Book No. 35, available on request by writing to: The Van Keuren Co., 174 Waltham St., Watertown, Mass.

VK

35th YEAR

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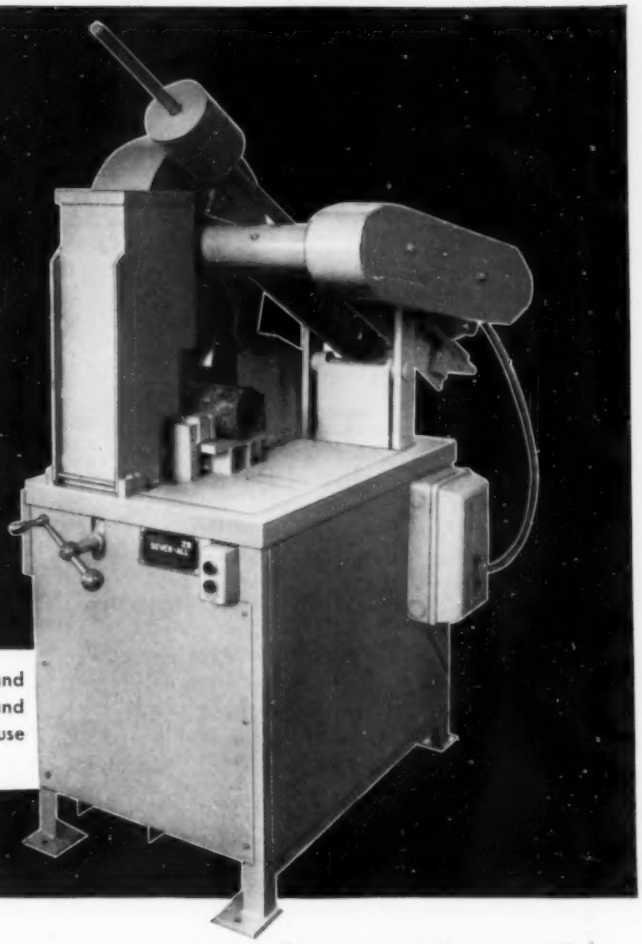


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Campbell Abrasive Cutter

New Model 28 Campbell Sever-All Dry Cutter

- Compact
- Portable
- Ideal for contract or construction work



CAPACITY: Solids up to 4" x 4" square, angles and channels to 8", tubes and pipes to 4" O.D., 4" angles and channels and 4" O.D. pipe at 45° angles. Based on use of 18" cutting wheel and 10 H.P. motor.

Here's a versatile cutter you can take to the job

• This new CAMPBELL Model 28 SEVER-ALL Abrasive Cutter is a dry-cutting machine which combines the capacity for a wide variety of cutting operations with a compactness which permits a portability seldom found in cutters of its type and capacity. It is ideal for cutting all types of material in contract or construction work. Can be supplied with work stop and with wheels for easy movement from job to job.

From front to back, the SEVER-ALL measures but 56". It is only 32" wide and 62" in height. Other important features include:

1. Work clamped on both sides of cut by hand-operated, self-centering work holders. Can be supplied with foot-operated treadle.

2. Time of cut is approximately 3 seconds per square inch of material.

3. Operator safety provided by complete enclosure of cutting wheel during operation—except for openings to clear the work.

4. Lowering of guard permits accurate location of work, permits long pieces to be placed in machine without threading through.

This Model 28 SEVER-ALL cutter is the newest of a long line of CAMPBELL Abrasive Cutters which provide many exclusive features. CAMPBELL field engineers are conveniently located to consult with you on ALL your cutting problems. Write today for specifications on the SEVER-ALL or **Bulletin DH-301** on the CAMPBELL Abrasive Cutting Method.

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T35	An Orderly Use Classification of Cutting Fluids
T36	What's Known Today About Machining Titanium
T37	Preparation and Tooling for Cold Pressure Welding
T38	Visualizing Plant Layout in Three Dimensions
T39	The Challenge of Automation
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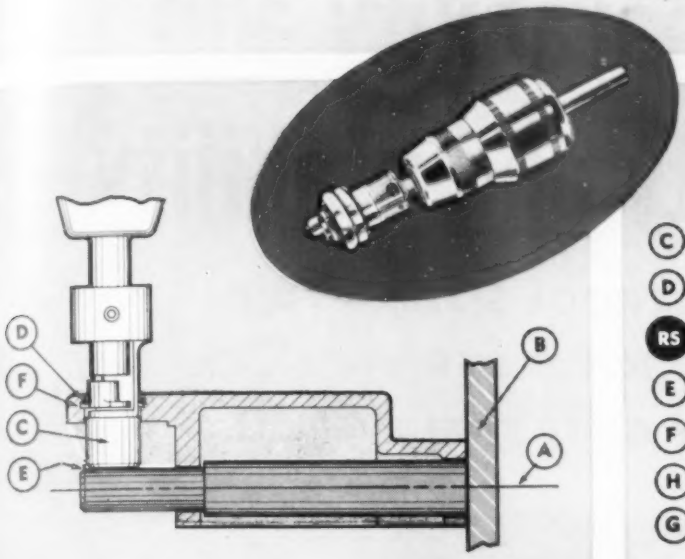
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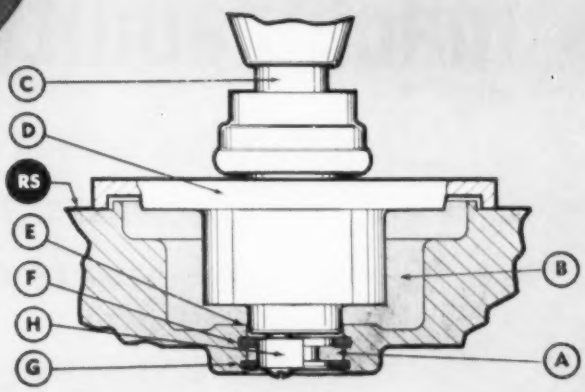
Waldes Truarc grooving tool solves tough internal grooving problems, cuts costs in assembly-line production



Problem: Locating a Groove From Centerline of a Hole A.

(a) Workpiece is fitted into plug on fixture plate **B**.

(b) Bottom adaptor **C** on standard Waldes Truarc Grooving Tool is piloted into bore **D** and registers on side of plug **E**. Groove **F** is cut in exact location required.



Problem: Cutting Two Grooves—One Rectangular, One Beveled—Located In Bore *A* In Large Cavity *B* of Workpiece, and Located From Reference Surface *RS*.

(a) Waldes Truarc Grooving Tool is fitted with elongated spindle assembly **C** and special bushing **D** which spans large cavity permitting tool to register on reference surface ***RS***. Bushing also pilots tool into counter-bore at ***E***.

(b) Both grooves **F** and **G** are cut simultaneously with special form cutter ***H*** having both required contours.

AMAZINGLY VERSATILE! The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even *unskilled labor* can perform and maintain high precision, mass production operations.

WIDE CUTTING RANGE! The Waldes Truarc Grooving Tool comes in five models: A-1, A-2, A-3, B and C. This wide variety of models enables you to cut accurate grooves in housings with diameters from .250 to 5.00 inches. Special features, modifications and adaptations allow each model to operate efficiently under many varying conditions.

SEND YOUR PROBLEMS TO WALDES! Whatever your internal grooving problem, send us your blueprints and let Waldes Truarc engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job.



WRITE *NOW* FOR 20-PAGE MANUAL CONTAINING FULL INFORMATION ON WALDES TRUARC GROOVING TOOL



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GROOVING TOOL

MADE BY THE MANUFACTURERS OF
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WALDES TRUARC GROOVING TOOL MANUFACTURED UNDER U. S. PAT. 2,411,426

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

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★

Only GRAPH-MO® steel rates so high on wearability and machinability and stability

OUTWEARS OTHER TOOL STEELS 3 TO 1

MACHINES 30% FASTER

IS THE MOST STABLE GAGE STEEL EVER MADE

GRAPH-MO® is the only tool steel that combines these advantages.

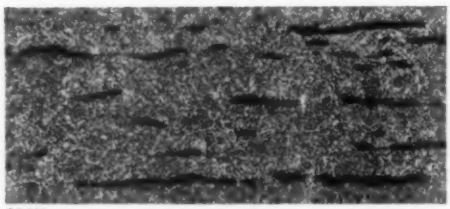
The gages or dies you manufacture or buy will stay accurate longer if they're made from Graph-Mo steel. Tests prove its stability. For example, a typical master plug gage made of Graph-Mo steel showed less than 10 millionths of an inch variation from its original dimensions after 12 years of use!

A combination of free graphite and diamond-hard carbides in the structure of Graph-Mo steel makes it wear longer. Reports from users show that Graph-Mo steel outwears other tool steels on an average of 3 to 1.

The free graphite particles cut production time, too. Constant Pressure Machinability tests show that Graph-Mo steel machines 30% faster than other tool steels. And Graph-Mo steel has minimum tendency to pick up, scuff or gall. Graphite particles act as a "built-in" lubricant. Tests on Amsler Wear Machine show Graph-Mo steel has twice the resistance to galling when compared with ordinary tool steels.



Graph-Mo steel master plug gage (above) used in 12-year stability test. Photomicrograph (below) shows free graphite and diamond-hard carbides that give Graph-Mo unusual wear resistance.

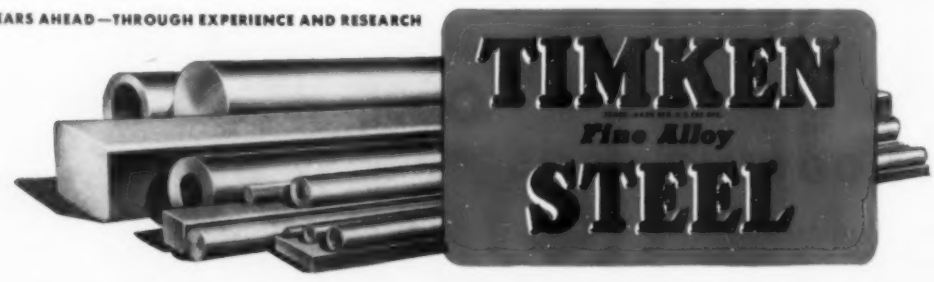


100X

You can always tell Graph-Mo steel by its "graphitic look"—the tiny, scattered, parallel marks barely visible on a piece of polished Graph-Mo. Insist on this built-in "trade-mark" the next time you buy gages or tool steel.

For more information, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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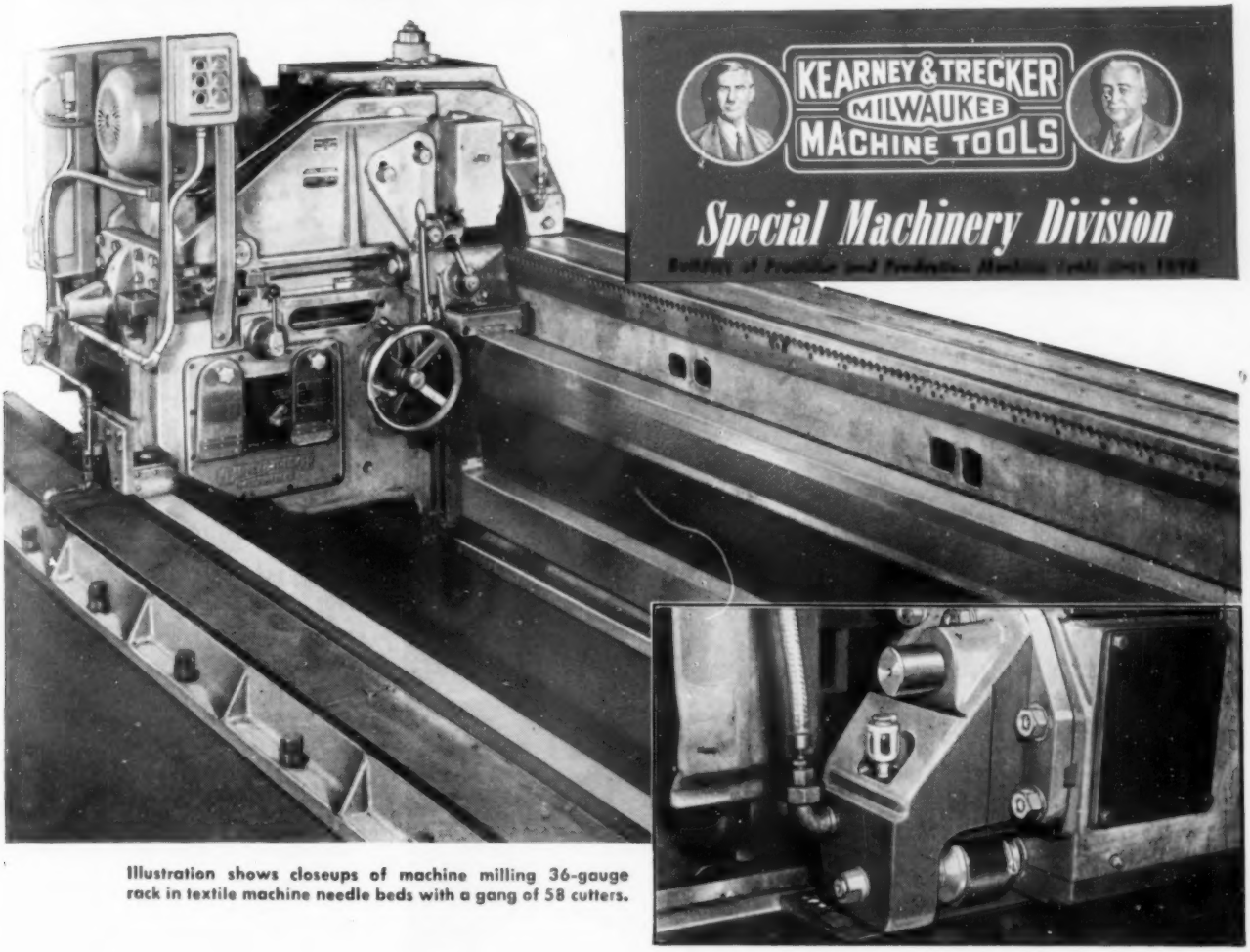


Illustration shows closeups of machine milling 36-gauge rack in textile machine needle beds with a gang of 58 cutters.

This production machine mills racks of varying pitches, widths and lengths

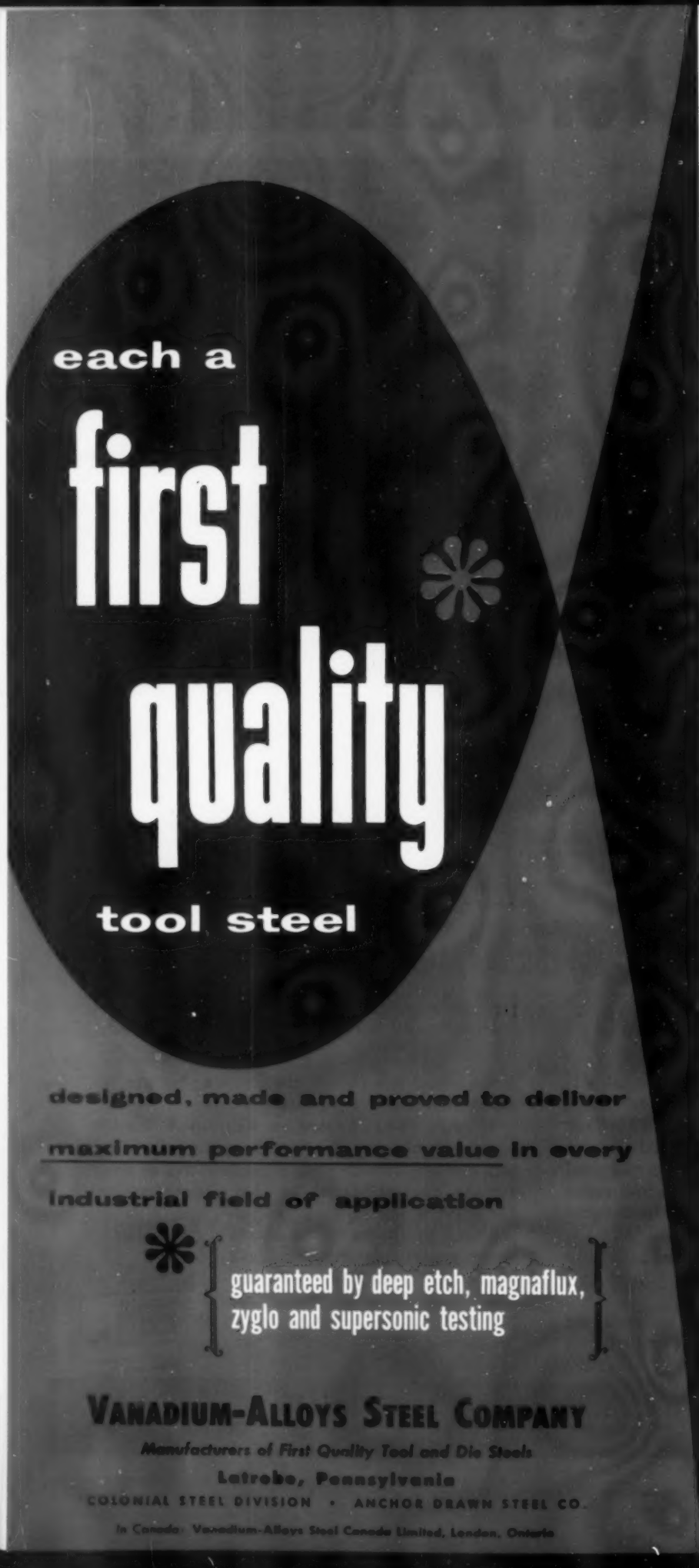
Here is another example of how the Special Machinery Division of Kearney & Trecker helps solve specific production problems. This rack milling machine was designed and produced for a textile machinery manufacturer who required a highly versatile machine that could mill racks up to 14′ long with widely varying characteristics. The table has a working surface of 18″ x 19′, and the entire traveling head and knee assembly is rigidly supported on three hardened and ground steel ways.

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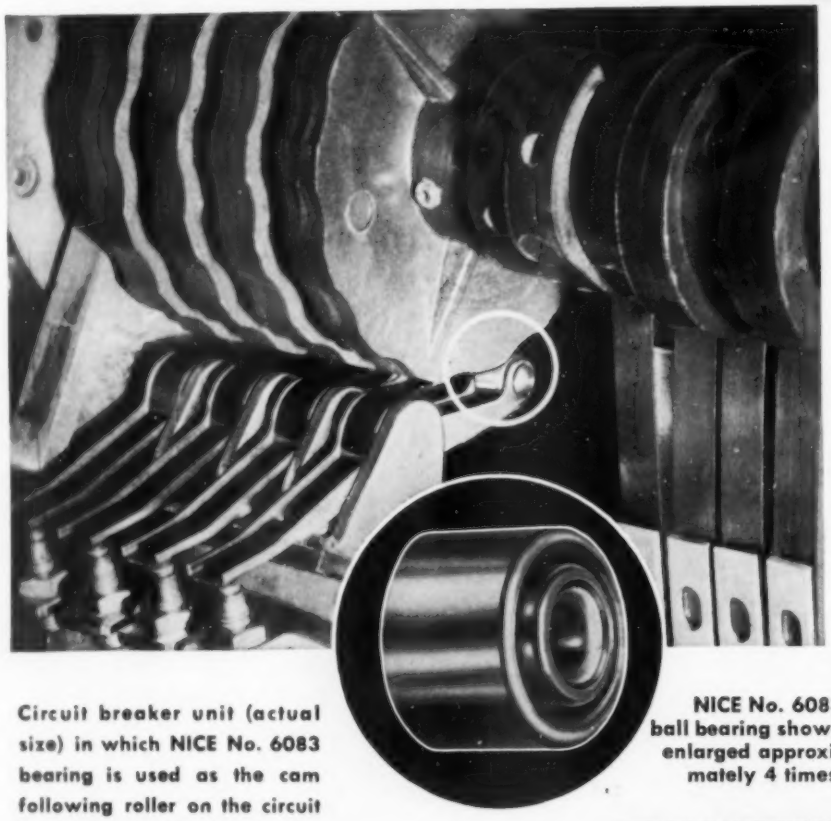
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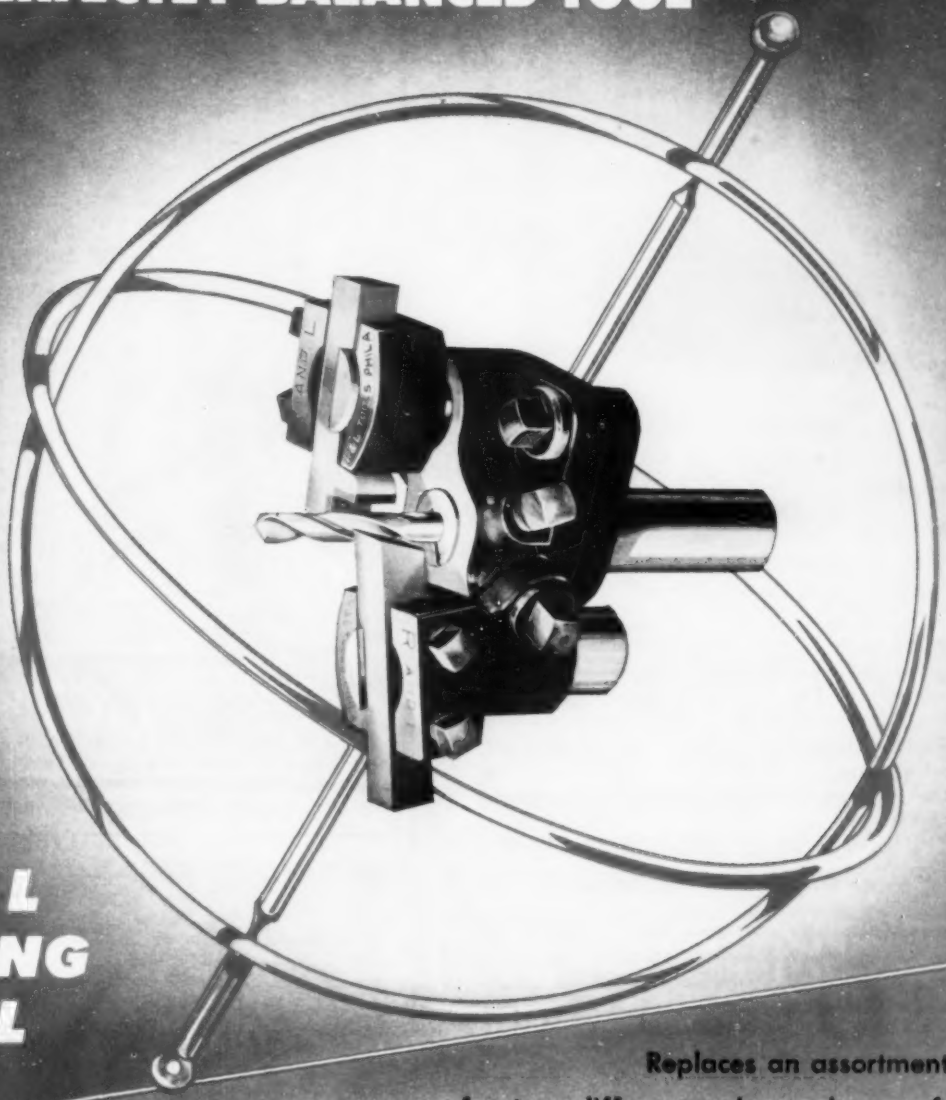
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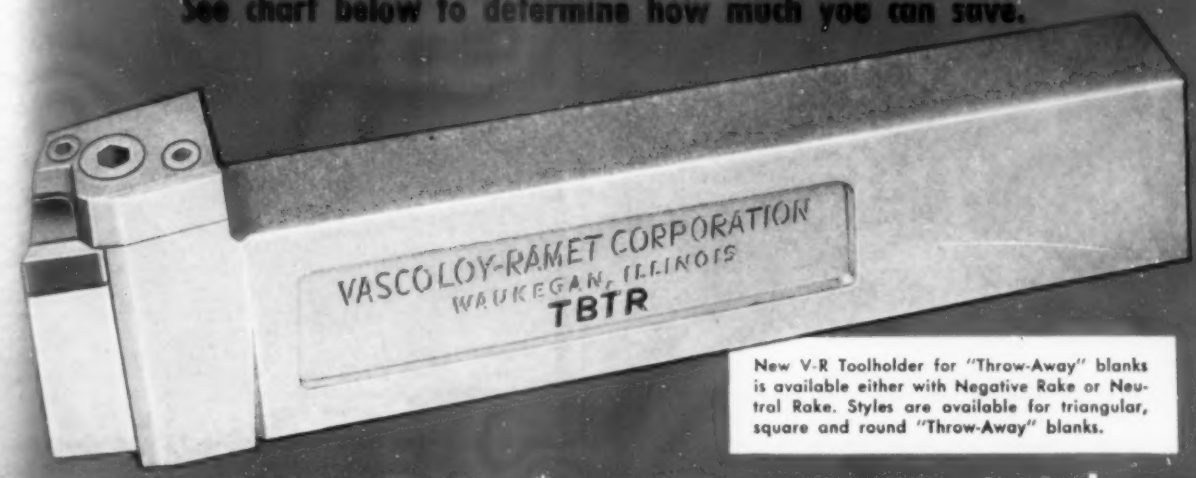
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More Economical Than Brazed Tools

Compare The Cost Per Cutting Edge...

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1. Original cost of the tool
2. Cost of each regrind
3. Number of regrinds obtainable

V-R "Throw-Away" Blank Cost Per Cutting Edge

"Throw-Away" Blank Style and Size	Triangular				Square		Round	
	¼"IC	⅜"IC	½"IC	⅝"IC	⅜"sq	½"sq	⅜"	½"
Utility Class for NEGATIVE RAKE Type	.06	.10	.20	.33	.07	.15	..	..
UTILITY Class for NEUTRAL RAKE Type	.12	.20	.40	.66	.15	.30	..	..
PRECISION Class for NEGATIVE RAKE Type	.10	.17	.27	.42	.13	.23	.06	.11
PRECISION Class for NEUTRAL RAKE Type	.20	.34	.54	.84	.27	.47	.16	.26

Formula for computing cost per cutting edge

$$\frac{\text{(Cost of Tool)} + \text{(No. of regrinds} \times \text{cost per grind)}}{\text{Number of regrinds} + 1 \text{ (for original tool)}} = \text{Cost per cutting edge}$$

Compute the cost per cutting edge for a typical brazed tool you use and compare it with cost per cutting edge of a "Throw-Away" blank!



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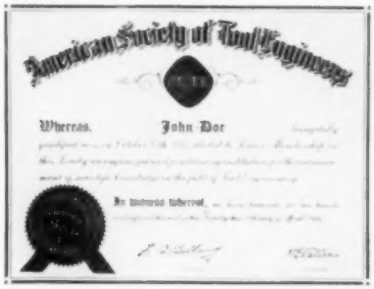
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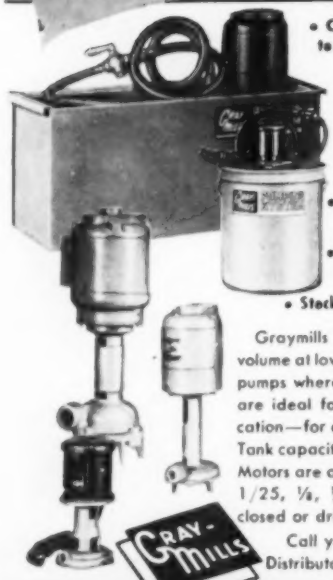
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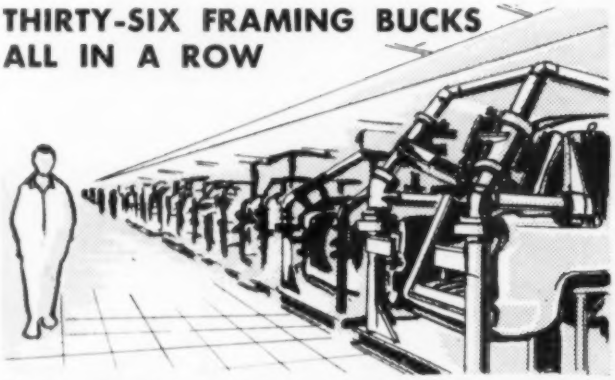
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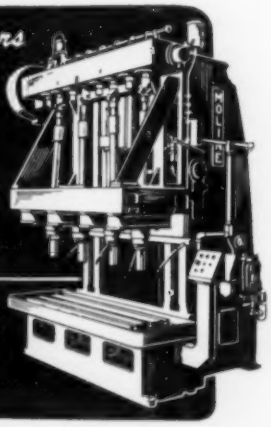
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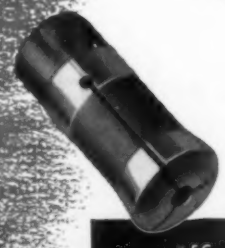
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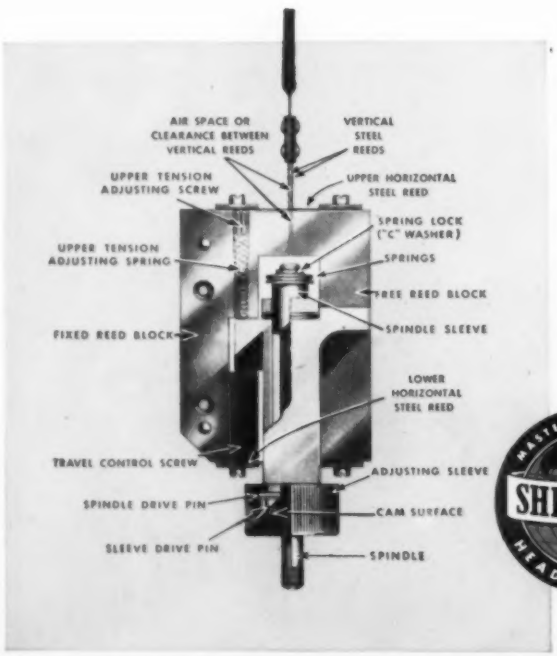
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